National Defence / Défense nationale

B-GL-358-001/FP-001

LAND FORCE INFORMATION OPERATIONS

ELECTRONIC WARFARE
(ENGLISH)

(Supercedes B-GL-321-004/FT-001, dated 1989-07-31)

WARNING

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Issued on the Authority of the Chief of Land Staff

Canada

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Issued on the Authority of the Chief of Land Staff

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FOREWORD

1. B-GL-358-001/FP-001 *Land Force Information Operations—Electronic Warfare* is issued on the authority of the Chief of the Land Staff.

2. B-GL-358-001/FP-001 *Electronic Warfare* takes effect upon receipt and replaces the B-GL-321-004/FT-001 *Signals in Battle, Volume 4, Tactical Electronic Warfare*, dated 1989-07-31.

3. The French version of this publication is B-GL-358-001/FP-002.

4. Suggested amendments should be forwarded through normal channels to the Directorate of Army Doctrine.

5. Unless otherwise noted, masculine pronouns contained herein refer to both genders.

6. This publication is available electronically on both the Defence Information Network (DIN) and the World Wide Web in the Army Electronic Library. Keyword—Army Electronic Library.

PREFACE

1. The foundations for Canadian Land Force (LF) doctrine are the capstone and keystone manuals in the B-GL-300 series. An understanding of the capstone and keystone doctrine is fundamental to the understanding of any of the supporting doctrinal publications. Of particular importance to this publication is B-GL-300-005/FP-001 *Information Operations*. It is the keystone manual that establishes the intelligence, surveillance, target acquisition and reconnaissance (ISTAR) concept and defines electronic warfare (EW) as an integral component of Canadian LF information operations. It should be read in conjunction with this publication.

2. The introduction of the ISTAR concept in B-GL-300-005/FP-001 *Information Operations* marked the beginning of the Army's transition from machine age warfare to information age warfare. This publication follows that path and explains the doctrinal and operational framework within which LF EW fits. It must be understood that a fundamental precept of LF operations stipulates that EW is an integral element of a formation ISTAR capability. In this regard B-GL-352-001/FP-001 LF *Information Operations: ISTAR* should also be read.

3. Of note the LF doctrinal model is in transformation from the six combat functions—command, information operations, manoeuvre, firepower, protection and sustain—to the five operational functions—command, sense, act, shield and sustain. For the purposes of this publication the transformation is irrelevant, as the content herein remains unchanged as the combat capability of EW moves from information operations to Sense and Act in terms of a doctrinal model. However, until the keystone manuals for Sense and Act are written, B-GL-300-005/FP-001 *Information Operations* remains the keystone manual pertaining to EW.

4. The LF does not conduct operations in isolation. This publication represents LF tactical EW doctrine only. An understanding of joint and combined operations as they pertain to EW is necessary but beyond the scope of this publication. B-GG-005-004/AF-000 *CF Operations* (dated 2000-12-18) and B-GG-005-004/AF-010 *CF Information Operations* (dated 1998-04-15) provide the CF Joint doctrinal position wrt EW.

5. This publication introduces a few new doctrinal concepts, which are already employed by the Army. It introduces the light, medium and heavy troop structure employed by the EW squadron as

the basis for force generation of tailored EW capability and documents the employment of a signal intelligence satellite support element (SSE) integrated into a deployed tactical EW capability. As well the doctrinal concept of a mobile EW team (MEWT) is introduced and defined.

6. The abbreviation SIGINT has only one meaning within this publication. It is the generic product derived from the combination of tactical or strategic level electronic support measure (ESM) function. It is not used to identify any national signal intelligence organization or to designate any future force generator.

TABLE OF CONTENTS

TABLE OF FIGURES

CHAPTER 1
INTRODUCTION

SECTION 1
THE STRATEGIC, OPERATIONAL AND TACTICAL CONTEXT

INTRODUCTION

1. Electronic warfare (EW) has been practiced in every conflict since World War I. Fundamentally, the practice of EW has not changed. However, the context in which EW must operate has. The Canadian Land Force has developed new doctrine and has placed a greater emphasis on joint and coalition operations. As well, closer relationships with national and strategic agencies have had significant impacts on the conduct of EW. The purpose of this chapter is to place EW in context of these new developments.

DEFENCE OBJECTIVES

2. **Mission**. Canada faces no direct military threat to its sovereign territory. Nevertheless, there remain direct and indirect threats to our national security for which a military response may be required. The Canadian Forces are responsible to defend Canada and Canadian interests and values while contributing to international peace and security.[1] In B-GL-300-000/FP-000 *Canada's Army*, strategic doctrine sets the context for all Canadian Land Force doctrine.[2] That doctrine divides the mission for the Land Force into three separate defence objectives:

a. **Defence of Canada**. The Land Force defends Canada by operating alone or jointly with the air and maritime forces. They assist in the conduct of surveillance and control of Canada's territory, airspace and maritime areas of jurisdiction and respond to requests from provincial authorities for

[1] Shaping the Future of the Canadian Forces: A Strategy for 2020 (June 1999).

[2] B-GL-300-000/FP-000 *Canada's Army, We Stand on Guard for Thee* provides a more detailed explanation of the subjects covered here.

aid of the civil power. The Land Force contributes by providing humanitarian and disaster assistance at home and assisting law enforcement agencies within Canada.

b. **Collective Security**. When directed, Canada's forces operate in combined operations to deter or contain aggression against Canada and Canada's allies. These missions may be in defence of the North American land mass in concert with the United States or abroad as part of NATO or a coalition force.

c. **Contribute to Global Stability and Peace**. Canada contributes to global stability by the provision of forces to peacekeeping mission under the auspices of the United Nations, through arms control verification and humanitarian and disaster relief abroad.

SPECTRUM OF CONFLICT

3. Armed forces are employed throughout a spectrum that runs from peace to war.[3] The Land Force will be required to operate throughout that spectrum. It does this by a combination of combat and non-combat operations. Combat operations are operations where the use or threatened use of force, including lethal force, is essential to impose our will on an opponent or to accomplish a mission. Non-combat operations are ones in which weapons may be present, but their use or threatened use is for self-protection and is not otherwise essential to accomplish a mission. While there is some overlap, combat operations are generally consistent with war fighting and non-combat operations predominate in operations other than war (OOTW).

[3] B-GL-300-001/FP-000 *Conduct of Land Operations – Operational Level Doctrine for the Canadian Army* provides additional information.

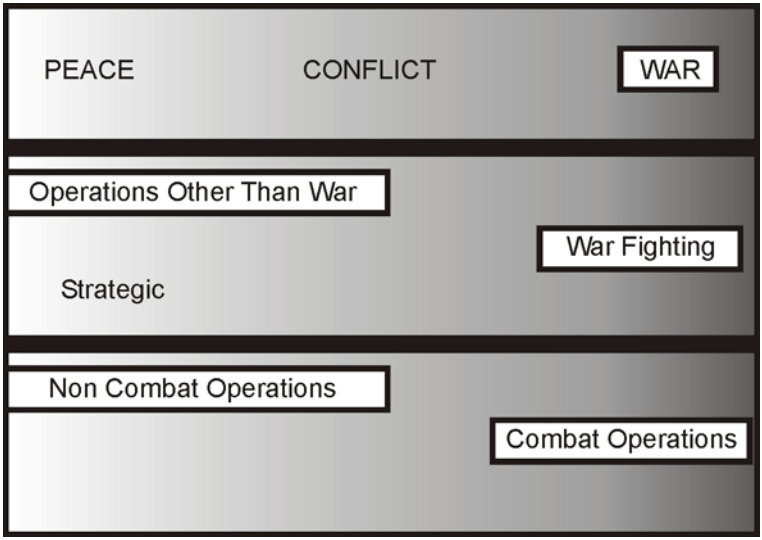

Figure 1-1: The Spectrum of Conflict

LEVELS OF CONFLICT

4. There are three levels of conflict. The **strategic** level entails the application of a nation's resources—moral, economic, scientific, technological and military—to achieve political objectives. At this level, national aims are established, direction is given and resources are allocated. At the **operational** level, the strategic aims and direction are considered and allocated resources are employed in military campaigns and major operations. They are usually joint and often combined in nature. At the **tactical** level, battles and engagements are planned and executed in accordance with the operational plan. It is at the tactical level that combat and non-combat operations take place. It is important to understand that each of these levels is defined by the intended outcome and not by the size of the force involved.

FUTURE WARFARE SCENARIOS

5. In "The Future Security Environment," the Army has adopted the NATO concept that there are two views of future conflict. In "View 1," conflict is between the near mirror image armed forces of nation states. This type of conflict is expected to be expeditionary, joint and combined in nature. This view of warfare is expected to be

mobile and fast paced, spread over a larger area with fewer forces, but not necessarily of a short duration. In "View 2," conflict involves non-state actors and is likely to be characterized by the presence of more irregular forces than View 1. Opponents will not necessarily be soldiers or even dressed in military uniforms. Our forces will be more vulnerable to attacks on lines of communication in View 2 conflict.[4]

MANOEUVRE WARFARE

6. Manoeuvre warfare has the following objective: to defeat the adversary by shattering his moral and physical cohesion, his ability to fight as an effective coordinated whole, rather than by destroying him physically through incremental attrition. This approach strikes a balance between use of physical destruction and moral coercion, emphasizing the importance of the latter, to attack the adversary's will. The following characteristics further clarify manoeuvre warfare[5]:

a. It aims to defeat the adversary by destroying his will and desire to continue by seizing the initiative and applying constant and unacceptable pressure at the times and places least expected.

b. The emphasis is on the defeat and disruption of the adversary rather than attempting to hold or take ground for its own sake.

c. Generally, it aims to apply strength against vulnerability, in contrast to attrition warfare where strength tends to be applied against strength.

COMBAT POWER

7. Combat power is the total means of destructive and/or disruptive force which a military unit or formation can apply against an opponent at a given time and place. It is generated by the integration of a number of elements referred to as combat functions. The Army defines six combat functions: command, information

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[4] DLSC Report 99-2 "The Future Security Environment," pp., 57-63.

[5] B-GL-300-001/FP-000 *Conduct of Land Operations – Operational Level Doctrine for the Canadian Army* and B-GL-300-003/FP-000 *Land Force Command* are sources of more information on manoeuvre warfare.

operations, manoeuvre, firepower, protection and sustainment. The aim is to convert the potential of forces, resources and opportunities into actual capability that is greater than the sum of the parts. Integration and coordination are used to produce violent, synchronized action at the decisive time and place required to find, fix and strike the adversary. The application of tempo, designation of a main effort and synchronization generate combat power through the integration of the combat functions.[6]

Figure 1-2: Combat Power Model

MISSION COMMAND

8. Mission command,[7] the Army's philosophy of command within the manoeuvre warfare approach to fighting, has three underlying principles:

a. a subordinate must clearly understand his superior commander's intent;

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[6] B-GL-300-001/FP-000 *Conduct of Land Operations – Operational Level Doctrine for the Canadian Army* provides additional information.

[7] B-GL-300-003/FP-000 *Land Force Command* is the source for more information on manoeuvre warfare.

b. that subordinate is responsible to fulfill his superior commander’s intent; and

c. that subordinate’s decision-making must be timely.

9. While subordinates must act within the framework of their commander's intentions, they must also be granted the freedom to act. This requires a style of command that promotes decentralized decision-making, freedom and speed of action, and initiative. Mission command meets this requirement and is thus key to the Army's doctrine. Under the mission command philosophy, commanders must:

a. give orders in a manner that ensures that subordinates understand intent, their own tasks and the context of those tasks;

b. tell subordinates what effect they are to achieve and the reason why it needs achieving;

c. allocate appropriate resources to carry out missions and tasks;

d. use a minimum of control measures not to limit unnecessarily the freedom of action of subordinates; and

e. allow subordinates to decide within their delegated freedom of action how best to achieve their missions and tasks.

BATTLEFIELD FRAMEWORK

10. At the operational and tactical levels, the battlefield is organized for combat[8]:

a. **Area of Operations**. Each commander is allocated an area of operations (AO), which is the volume of space in which that commander has the authority for the conduct of military operations. For any one level of command, AOs will never overlap.

[8] B-GL-300-002/FP-000 *Land Force, Vol 2, Land Force Tactical Doctrine* explains these subjects in more detail.

b. **Area of Interest**. Beyond this area, a commander has an area of interest (AOI). This area helps the commander identify and monitor factors, including adversary activity, which may affect the commander's future operations. A commander will decide for himself how far he must look, in both time and space.

c. **Area of Influence**. The area of influence is the volume of space in which a commander can engage the adversary. The range of systems under command determines the size of the area of influence.

d. **Area of Intelligence Responsibility**. The area of intelligence responsibility (AIR) is an area allocated to a commander, in which he is responsible for the provision of intelligence, within the means at his disposal. This area is within a commander's AO; however, it may extend beyond his weapons engagement range, especially in OOTW, and may be assigned to him in regard to the capability of his organic collection systems to fulfill his higher commander's requests for intelligence.

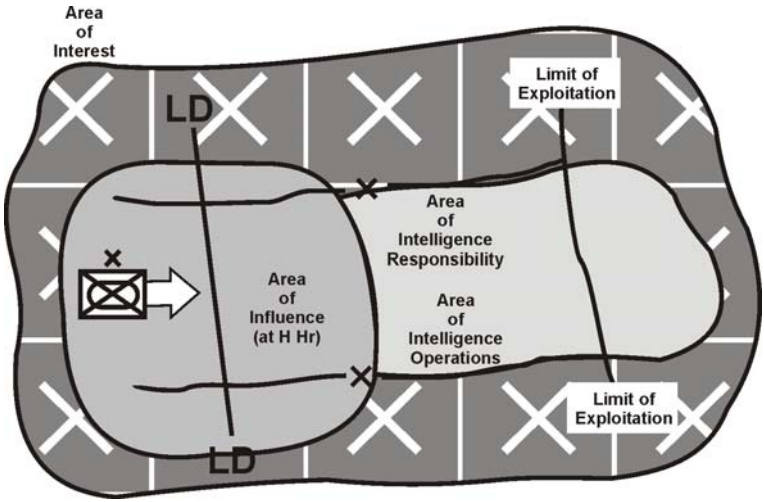

Figure 1-3: Battlefield Framework

11. Within the AO, further distinction is made between **deep, close and rear** operations. **Deep operations** are normally those conducted against the adversary's forces or resources not currently engaged in the close fight. They prevent the adversary from using his resources where and when he wants to on the battlefield. **Close operations** are usually the corps and division current battle and include the engagements fought by brigades and battalions. **Rear operations** assist in providing freedom of action and continuity of operations, logistics and command. Their primary purpose is to sustain the current close and deep operations and to posture the force for future operations.

SECTION 2
INFORMATION OPERATIONS AND ELECTRONIC WARFARE

THE INFORMATION ENVIRONMENT

12. Commanders rely upon information to make decisions. With the advent of the information age, military commanders are faced with a great deal of information. We define the environment in which they operate as the information environment. The global information environment (GIE) is comprised of all sources of information that are available. The GIE includes all individuals, organizations or systems, most of which are outside the control of the military or government. The military information environment (MIE) is that portion of the GIE relevant to military operations. The MIE includes sources under the direct control of a particular commander, sources from superior headquarters and from open sources. The interaction of the GIE and the MIE introduces many more players into the AO, compresses the traditional levels of conflict in time but expands them in space and gives operations a simultaneous and continuous character. Tactical military operations are more likely to have political and social implications, requiring additional focus on non-military factors in planning and execution.[9]

13. The information age has expanded a commander’s AOI to include portions of the GIE and MIE that are relevant to his mission. His AOI may now include activities in the host nation’s political,

[9] For more detail on the GIE and MIE see B-GL-300-005/FP-001 *Land Force Information Operations.*

economic and social environment. It will include opinions, attitudes and events that occur back in Canada, whether they are directly relevant to his mission or not. It may also include statements made by leaders of large international bodies like the UN, NATO or the Organization for Security and Cooperation in Europe (OSCE).

14. The information age has also allowed the commander to access more information from within his expanded AOI. National communications and intelligence links provide him access to all the resources of the CF, in addition to the forces allocated to his command. It allows a commander to have access to specialist advisors as required. This allows economy of effort since such advice may only be rarely required, and the deployment of the specialist may not be feasible. Specialist intelligence analysis is an example of this type of advice.

INFORMATION OPERATIONS[10]

15. Information operations (IO) are an essential element of combat power that allows modern commanders to exercise mission command within the manoeuvrist approach to operations in the information age. In its simplest form it encompasses all operations that gain information and knowledge that enhances friendly execution of operations, while denying the adversary similar capabilities by whatever means possible. The principal objective of IO is to achieve superiority and relative advantage between the friendly commander's decision-action cycle and that of the adversary and to use that advantage to enhance and enable other elements of combat power. The application of IO enhances battlefield visualization and improves designation of main effort, control of operational tempo and synchronization. Information operations is divided into four support components and two action components.

a. **Support Components**. The four support components of IO are:

(1) communications and information systems (CIS);

(2) relevant information;

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10 B-GL-300-005/FP-001 *Land Force Information Operations* is the source for IO doctrine.

(3) civil-military cooperation (CIMIC); and

(4) public affairs (PA).

b. **Action Components**. The two action components of IO are offensive information operations (Off IO) and defensive information operations (Def IO). The elements of these components are:

(1) operations security (OPSEC);

(2) counter-intelligence (CI);

(3) military deception;

(4) psychological operations (PSYOPS);

(5) counter-PSYOPS;

(6) EW;

(7) computer network attack (CNA);

(8) special information operations (SIOs); and

(9) physical destruction.

ELECTRONIC WARFARE IN INFORMATION OPERATIONS

16. Electronic warfare has been placed in the IO combat function. Although it has been placed as an action component of IO, EW crosses all aspects of IO and several of the other combat functions. Electronic warfare consists of three components: EW support measures (ESM), electronic countermeasures (ECM) and electronic protective measures (EPM).[11] In general these components provide exploitation, disruption and denial of information within the electromagnetic (EM) spectrum.[12]

17. Each of the components of EW corresponds directly with IO support and action components, off and def IO. ESM are a "single source" of information assisting in the development relevant information as part of IO support. ECM is a component of off IO aimed at attacking and/or disrupting the adversary's use of information in conjunction with the other IO action components. ECM can also be

[11] ESM, ECM and EPM will be defined in Chapter 2.

[12] See Chapter 2.

considered a firepower asset and requires close coordination with other firepower assets through the targeting process. EPM are a component of def IO aimed at protecting friendly information and our ability to use the EM spectrum. EPM is also a component of overall protection of the force.

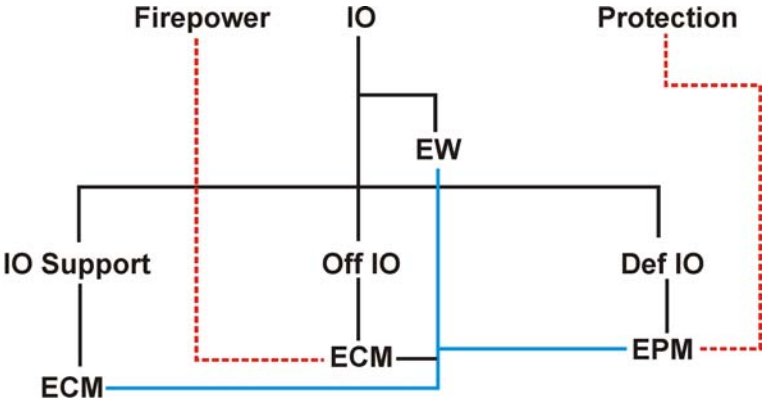

Figure 1-4: Electronic Warfare in Information Operations

SECTION 3
INTELLIGENCE, SURVEILLANCE, TACTICAL ACQUISITION AND RECONNAISSANCE AND ELECTRONIC WARFARE

INTRODUCTION

18. The essence of the manoeuvre warfare approach to operations is to focus on the adversary, determine his weaknesses, attack them and shatter his will. A comprehensive intelligence, surveillance, tactical acquisition and reconnaissance (ISTAR) capability is essential for successfully applying this approach. The role of ISTAR is to provide commanders with situational awareness (SA) and to cue manoeuvre and offensive strike assets.

19. An ISTAR system can be defined as a structure within which relevant information, collected through systematic observation, is integrated and processed in order to meet the commander's intelligence requirements. It also permits the detection, identification and location of targets in sufficient detail and in a timely enough manner to allow their successful engagement by weapon systems. It is a system which comprises the following:

a. sensors, which act as collection assets;

b. processors, which act as an information collection and analysis system;

c. an information and sensor management system; and

d. an effective system linking ISTAR assets and the commander.

20. The ISTAR system integrates sensor capabilities and the intelligence process that provides the direction and processing of sensor data. These capabilities have been resident in Canadian doctrine for many years. Information technology has made the integration of the data and information from the sensor systems more effective, and a synergy results from this new system. As an integration of existing capabilities, ISTAR is a system of systems comprising the following component parts:

a. **Intelligence**.[13] Intelligence encompasses three things: a process, a product and an organization. In the case of ISTAR, the "I" stands for intelligence as a function that processes data and information from all sources and single-source intelligence into predictive estimation of an adversary's capabilities and intentions. Intelligence is the combination of Red and Brown SA. It is knowledge as expressed in the cognitive hierarchy.

b. **Surveillance**.[14] Continual surveillance provides for the collection of information on an adversary. It is conducted by observation of the adversary and terrain using optics, electronic detection, thermal imagery, radar, satellites, unmanned aerial vehicles

[13] Intelligence. The product resulting from the processing of information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. The term is also applied to the activity, which results in the product, and to the organizations that engage in such activity (A-AD-121-F01/JX-000 *Canadian Forces Manual of Abbreviations*).

[14] Surveillance. Systematic observation of the aerospace, surface or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic or other means (A-AD-121-F01/JX-000 *Canadian Forces Manual of Abbreviations*).

(UAVs), ground sensors and all other means available. Surveillance implies that the adversary must act, move or radiate before it can be detected; it is reactive in nature.

c. **Target Acquisition**.[15] Target acquisition (TA) provides detailed information about the location of adversary forces, locating them with sufficient accuracy to enable weapon systems to engage those elements selected as targets. It includes TA for both direct and indirect fire weapons.

d. **Reconnaissance**.[16] Reconnaissance is proactive (in contrast to surveillance, which is reactive) in nature. Friendly assets are assigned a mission to obtain information about the adversary, regardless of its activities. Reconnaissance includes activities performed by reconnaissance units but is not restricted to those units. Many elements of the ISTAR system can perform reconnaissance functions.

21. As ISTAR is defined as a system of systems, EW, from a combat systems perspective, is one of those systems tasked to conduct ops in support of the intelligence, surveillance, TA and reconnaissance components of ISTAR.

SECTION 4
ELECTRONIC WARFARE AND THE OPERATIONAL FUNCTION MODEL

22. As mentioned in the Foreword, the Land Force is adopting a new doctrinal model, the Operational Function Model of command,

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[15] Target Acquisition. The detection, identification and location of a target in sufficient detail to permit the effective employment of weapons (A-AD-121-F01/JX-000 *Canadian Forces Manual of Abbreviations*).

[16] Reconnaissance. A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an adversary or potential adversary, or to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area (A-AD-121-F01/JX-000 *Canadian Forces Manual of Abbreviations*).

sense, act, shield and sustain. Figure 1-5 maps EW and its components into this new model.

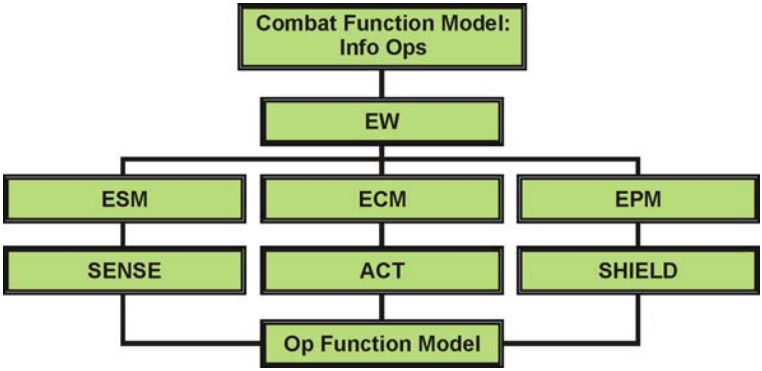

Figure 1-5: Mapping EW onto the Op Function Model

CHAPTER 2
ELECTRONIC WARFARE FUNDAMENTALS

SECTION 1
GENERAL

INTRODUCTION

1. Any future adversary is likely to make use of a full range of modern communications, surveillance and weapon systems operating throughout the electromagnetic (EM) spectrum. They may also be aware of the threat posed by our own electronic warfare (EW) resources. In general, all sides will attempt to dominate the EM spectrum by targeting, exploiting, disrupting, degrading, deceiving, damaging or destroying their adversary's electronic systems in support of military operations while retaining their own ability to make use of the same systems. There is a general perception that EW is in the realm of specialists. This is simply not the case. Electronic warfare has aspects that are clearly all arms and aspects that are specialized. As a consequence, it is essential that commanders at all levels have a clear understanding of EW, be supported by experienced EW staff and maintain an appropriate focus for the conduct of the battle to dominate the EM spectrum. Since EW has an impact on a large cross section of staff activities and battlefield functional areas, coordination of EW activities at all levels is essential. Specifically, close coordination between forward deployed Land Force (LF) EW assets and the Canadian Forces (CF) signal intelligence organization, CF Information Operations Group (CFIOG), is essential to ensure that maximum value is derived from the synergy of both activities.

THE ELECTROMAGNETIC SPECTRUM

2. Visible light is a form of energy. When it travels through the atmosphere, it is partly absorbed and reflected by all objects in its path. This action creates a pattern of light, shade and colour that enables the human eye to recognize objects. This form of energy is related to radio, radar and X-rays. All of these forms of energy have similarities and, collectively, are known as electromagnetic energy. The main similarity is that all electromagnetic energy travels in form of a wave. The wavelength of the energy (the distance between the wave crests) determines the form of energy, and there are an infinite variety of wavelengths. The whole range of wavelengths is known as

the electromagnetic spectrum (see Figure 2-1). All EM waves, regardless of their position in the EM spectrum, travel at the speed of light, which is approximately 300,000,000 metres per second. The EM spectrum is the domain of operations for LF EW.

APPLICATION OF EW RESOURCES

3. Electronic warfare may be conducted by a broad range of assets, ranging from a single soldier with man-portable equipment to a full squadron operating under armour. In order to maximize the capabilities of the CF signal intelligence system and LF EW assets, EW operations will, wherever possible, be integrated with coalition and CF EW and signal intelligence agencies.

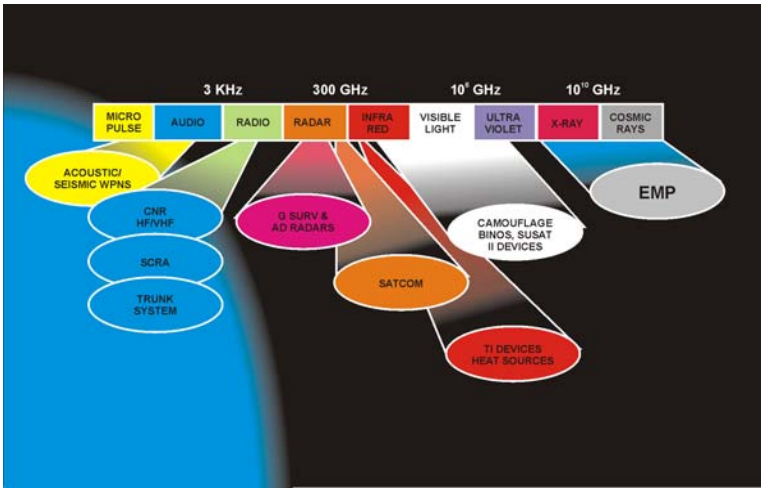

Figure 2-1: The Electromagnetic Spectrum

SECTION 2
EW DEFINITION

INTRODUCTION

4. The concept and doctrine of EW are derived from a series of definitions that, in general terms, explain the “boundaries” of the activity. The central definition for EW, from which subordinate definitions are derived, is as follows:

Military action to exploit the electromagnetic (EM) spectrum which encompasses the interception and identification of EM emissions, the employment of EM energy, including directed energy, to reduce or prevent hostile use of the EM spectrum and actions to ensure its effective use by friendly forces.[17]

5. The three components of EW are:

a. EW support measures (ESM);

b. electronic countermeasures (ECM); and

c. electronic protective measures (EPM).

SECTION 3
ELECTRONIC WARFARE SUPPORT MEASURES

INTRODUCTION

6. Electronic warfare support measures are defined as: that division of EW involving actions taken to search for, intercept and identify EM emissions and locate their sources for the purpose of immediate threat recognition. It provides a source of information required for immediate decisions involving ECM, EPM and taking other tactical actions.[18] It provides information that contributes to production of signals intelligence (SIGINT).

7. ESM systems collect data and/or produce information or intelligence which can be used to:

a. contribute as a "single source" of information for the production of Red situational awareness (SA) within the intelligence, surveillance, tactical acquisition and reconnaissance (ISTAR) system;

b. provide targeting information for ECM operations;

c. initiate self-protection measures;

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[17] NATO Military Committee (MC) 64 *NATO EW Policy*, NATO ATP 51(A) *EW in the Land Battle* and AAP-6 (U) *NATO Glossary of Terms and Definitions.*

[18] MC 64 *NATO EW Policy.*

d. support EPM efforts;

e. create or modify SIGINT data bases; and

f. provide warning to the supported commander.

8. ESM products are:

a. **Signals Intelligence (SIGINT)**. The generic term used to describe communications intelligence (COMINT) and electronic intelligence (ELINT) when there is no requirement to differentiate between these two types of intelligence. The term SIGINT is also used to represent a fusion of COMINT and ELINT.[19]

b. **Electronic Intelligence (ELINT)**. Technical material and intelligence information derived from EM non-communications transmission (e.g., radar, navigational aids, jamming transmissions) by other than intended recipients.[20]

c. **Communications Intelligence (COMINT)**. Technical material and intelligence information derived from EM communications and communications systems (e.g. Morse, voice, teleprinter, facsimile) by other than intended recipients.[21]

SECTION 4
ELECTRONIC COUNTERMEASURES

9. Electronic countermeasures are defined as: That division of EW involving actions taken to prevent or reduce an adversary's effective use of the EM spectrum through the use of EM energy. There are three subdivisions of ECM—electronic jamming, electronic deception and electronic neutralization[22]:

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[19] MC 101 *NATO Signals Intelligence Policy,* ATP 51(A) *EW in the Land Battle* and AAP-6 (U) *NATO Glossary of Terms and Definitions.*

[20] MC 101 *NATO Signals Intelligence Policy.*

[21] MC 101 *NATO Signals Intelligence Policy.*

[22] MC 64 *NATO EW Policy.*

a. **Electronic Jamming**. The deliberate radiation, re-radiation or reflection of EM energy with the object of impairing the effectiveness of electronic devices, equipment or systems being used by an adversary.[23]

b. **Electronic Deception**. The deliberate radiation, re-radiation, alteration, absorption or reflection of EM energy in a manner intended to confuse, distract or seduce an adversary or his electronic systems.[24]

c. **Electronic Neutralization.** The deliberate use of EM energy to either temporarily or permanently damage adversary devices, which rely exclusively on the EM spectrum.[25]

SECTION 5
ELECTRONIC PROTECTIVE MEASURES

INTRODUCTION

10. Electronic protective measures are defined as: That division of EW involving actions taken to ensure friendly effective use of the EM spectrum despite the adversary's use of EM energy. There are two sub-divisions of EPM:

a. **Active EPM**. Detectable measures, such as altering transmitter parameters as necessary, to ensure friendly effective use of the EM spectrum.

b. **Passive EPM**. Undetectable measures, such as operating procedures and technical features of equipment, which are meant to ensure friendly effective use of the EM spectrum[26].

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[23] MC 64 *NATO EW Policy.*

[24] MC 64 *NATO EW Policy.*

[25] MC 64 *NATO EW Policy.*

[26] MC 64 *NATO EW Policy.*

SECTION 6
THE ROLE OF ELECTRONIC WARFARE

11. The role of EW organizations is to provide the framework to carry out ESM and ECM. They also support defensive EW carried out by all arms/services. Specifically, the following tasks can be carried out by tactical EW organizations:

a. provide immediate threat warning;

b. provide “single source” tactical SIGINT in the form of EW summaries (EWSUMs) or tactical reports (TACREPs), which supports current operations and future planning;

c. provide target acquisition of adversary electromagnetic emitters;

d. provide ECM support; and

e. provide EPM advice.

SECTION 7
ELECTRONIC WARFARE CAPABILITIES

12. **General Capabilities**. To perform the roles/tasks assigned to them, EW elements must have the following basic capabilities:

a. a 24/7, all weather ESM coverage of the commander's area of interest;

b. a capability to conduct ECM—the range of a commander’s ECM capabilities contributes to his overall area of influence along with other combat systems;

c. the capability to process and secure highly classified information and special materials based on national policies and security orders;

d. a secure and reliable communication means within the EW organization, to the supported formation HQ, to the higher EW organization and to the national level organizations;

e. a capability to operate in an EW and/or nuclear, biological and chemical (NBC) environment;

f. the ability to operate either under armour (heavy EW) and using highly mobile platforms or man-packs (light EW) in order to effectively compliment the supported formation; and

g. enough redundancy to sustain operations.

13. **Equipment and System Capabilities**. EW equipment tends to be highly specialized and is required to adapt quickly to an ever-changing EM target presented by various adversaries. EW equipment forms modular components that can be integrated to allow multi-tasking and highly responsive, adaptable operations by ESM detachments. In brief, each ESM detachment has the technical capability to perform intercept and direction finding (DF) across the spectrum, including both COMINT and ELINT targets. These capabilities are organized and deployed depending on mission specifics and the target environment. They are as follows:

a. **ESM—Search/Intercept Capability**. These ESM capabilities consist of the personnel and equipment whose purpose is to search the EM spectrum for targets and gather detailed information on detected targets. A search/intercept component requires the following capabilities:

(1) broad band coverage search;

(2) interoperable with national strategic systems;

(3) the ability to be used in vehicle (platform independent) and/or dismounted operations;

(4) the ability to integrate with the DF capability to provide a single package capability;

(5) the ability to detect and track low probability of intercept (LPI) signals (e.g., frequency hopping);

(6) the ability to exploit targets throughout the threat spectrum;

(7) recording and storage capabilities; and

(8) the ability to interface directly with the EW analysis component.

b. **ESM—Communications Direction-Finding (DF) Capability**. This ESM component consists of a number of detachments with modular equipment that form baselines to provide location information of target communication emitters. The DF components require the following capabilities:

(1) sufficient accuracy to allow cueing of other sensor systems such as UAVs;

(2) broad band coverage to the greatest extent possible and in step with intercept capabilities;

(3) the ability to integrate with search and intercept capability to provide a single package capability;

(4) the ability to locate LPI emitters;

(5) the ability to be used in mounted (platform independent) and/or dismounted operations; and

(6) the ability to interface directly with the EW analysis component.

c. **ESM—ELINT Capability**. This ESM component is deployed in detachments with modular equipment that forms a baseline. The ELINT components provide search, intercept, direction finding and analysis of target non-communications emitters. The equipment conducts analysis by comparing emitter data to a database, which determines the radar type and associated equipment. An ELINT component must be capable of the following:

(1) broadband coverage of the radar frequency band;

(2) interoperability with national and other service systems;

(3) flexible, platform independent deployment;

(4) rapid reprogramming of new signals by field operators;

(5) interface with the land integrated support station (LISS) to enable 2nd level collation of new signals;

(6) interaction with standard electronic parameter databases such as the Canadian Forces EW Database (CFEWDB) and the NATO Emitter Database (NEDB);

(7) recording; and

(8) interface directly with the EW analysis component.

d. **ECM Capability**. The ECM component consists of a number of dedicated detachments and modular equipment, which may be integrated with ESM detachments for attacking both communication and non-communications targets, either in a deliberate or a surgical fashion. ECM detachments require the following capabilities:

(1) platform independence to the greatest extent possible;

(2) the ability to attack both communications and radar frequency bands;

(3) upgradeable; and

(4) capable of performing a range of ECM tasks, including but not limited to electronic masking, spoofing, deception and jamming.

e. **Analysis Capability**. The analysis component of an EW unit converts the data and information collected by the EW sensors into a “single source” product, EW summaries (EWSUMs) or tactical reports (TACREPs). This component consists of specially trained personnel and specialized equipment. It can be as simple as an analyst working along side a search/intercept operator. Analysis is usually conducted in a distributed fashion, with various baseline detachments, the SIGINT EW operations centre (SEWOC) and the EW coordination cell (EWCC) each adding layers of analytical refinement

to the end product. The component has the following capabilities:

(1) the capability to receive sensor data;

(2) tools to assist the analyst to process the data;

(3) EW trained analytical personnel;

(4) the ability to create, hold and secure highly classified materials and databases;

(5) access to other intelligence databases;

(6) the ability to interface directly with ESM and ECM components; and

(7) the ability to interface directly with national-level SIGINT databases.

f. **EW C2IS Capability**. EWCC, EWOC and EW liaison officer (EWLO) staffs at supported formation headquarters (as required) provide for the command and control of EW assets. The EW control and analysis centre (EWCAC) component is an EW specific C2IS consisting of personnel, information systems and physical facilities that provide the means to exercise command and control in forming the EWCC and EWOC. This component is supported by an integral signal organization of appropriate size. The EW C2IS capability must support the following:

(1) dispersed deployment of EW assets throughout the AO;

(2) interoperability with the Land Force Command and Control Information System (LFC2IS);

(3) the capability of handling highly classified information; and

(4) the capability of supporting timely transmission of data from the sensor to the end-product customer without requiring either hard-copy or “air gapping.”

g. **Combat Service Support Capability**. The combat service support (CSS) component provides the CSS necessary for EW operations. Electronic warfare organization are supported as other units of a formation are and in accordance with sustainment doctrine.[27] Electronic warfare organizations have specialist maintenance capabilities to support specialized fleets of EW equipment. Some equipment provided by the national/strategic level authorities will be maintained by those agencies and not through the integral LF EW unit CSS component.

SECTION 8
EW SUPPORT

14. In order to provide the best support to operational commanders, deployed EW units must take advantage of national and international capabilities to augment limited resources. A deployed LF commander will receive EW support from three areas:

a. organic EW resources;

b. resources from other nations in theatre (force level EW capabilities); and

c. Canadian national/strategic resources.

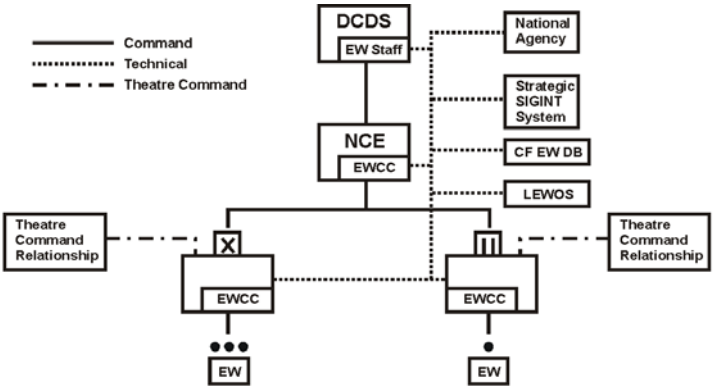
15. Organic EW resources provide the access to the national signal intelligence system. With limited resources, it is unlikely that LF organic resources will be able to provide all the EW information necessary for operations. EW units cannot provide their full potential combat effect without access to national signal intelligence systems.

16. Theatre EW units, depending on their tasks, may be able to provide both ESM and ECM support. This support will be coordinated by the EWCC. There may be national limitations on the provision of this support.

17. Canadian Forces Information Operations Group is to provide a CF level signal intelligence capability for the provision of databases,

[27] For more information see B-GL-300-004/FP-000 *Sustainment* and supporting sustainment system manuals.

specialized equipment, specialist operators and sanctuary operations.[28] Also, CFIOG will provide access, through the Canadian Security Establishment (CSE), to resources and information from allied nations and, via the land integrated support station (LISS), to the Canadian Forces EW Database (CFEWDB). Lastly, CFIOG will force generate a signals intelligence satellite support element (SSE) to augment deployed LF EW assets on an as required basis.



1. The NCE may not have a dedicated EWCC. If it does not then the EWCC within the deployed forces provides advice to the National commander as required.
2. LEWOS - Land EW Operational Support.
3. The Theatre Command relationship refers to the specific Command Relationship that the LF is under for an operation. Command relationships are detailed in B-GL-300-003/FP-000 Command. This would include technical control of EW resources.

Figure 2-2: National to Tactical EW Op Support

18. It is important to note that augmentation of a SSE results in the creation of either a SEWOC and/or a SEWCC capability as an SSE will locate with either the EWCC or EWOC.

[28] Sanctuary (or split based) operations is a term used to describe operations that are being conducted from a safe area (normally out of theatre in Canada) to directly support operations in theatre.

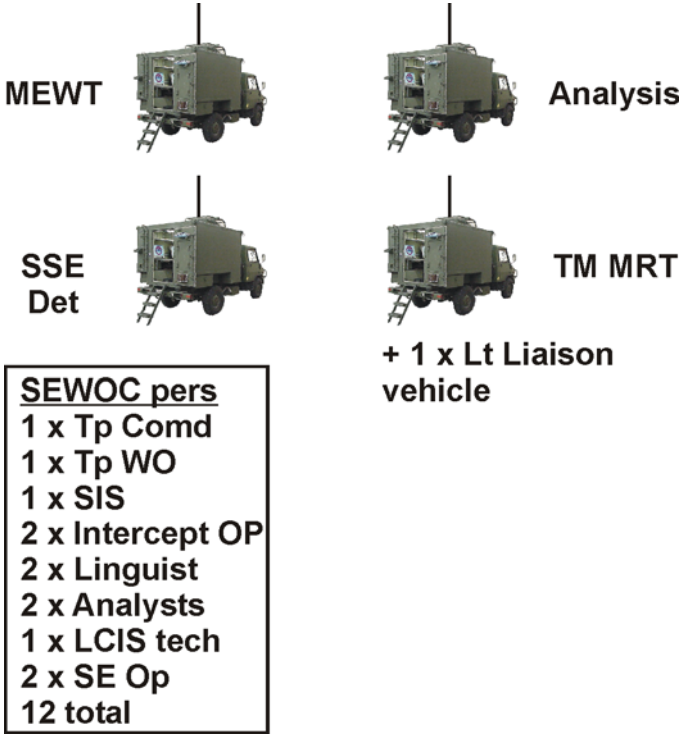


Figure 2-3: SEWOC

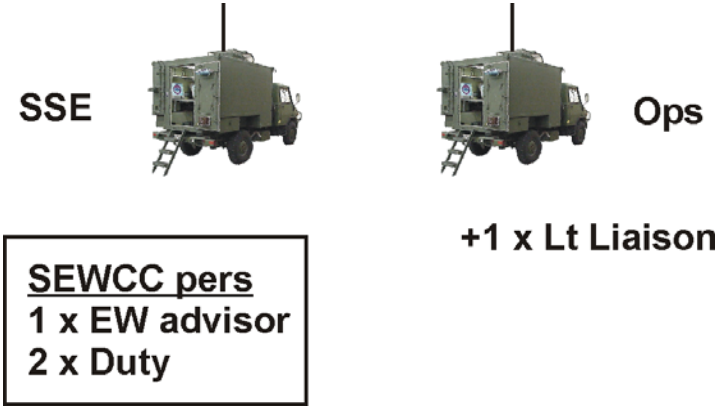


Figure 2-4: SEWCC

19. At the LF level, the LISS provides a Land EW operational support (LEWOS) capability to deployed LF EW systems. An example of this is the provision of a start state radar database for ELINT ESM ops during pre-deployment preparations.

SECTION 9
ORGANIZATION: FORCE GENERATION

20. The 2 EW Squadron is organized along mission-oriented lines and is capable of deploying in a scalable fashion. Troops within the squadron are tailored to respond to tasks across the spectrum of conflict, with one troop specializing in View 1 tasks and those View 2 tasks requiring armoured protection and a second troop specializing in View 2 tasks and/or View 1 tasks requiring additional mobility, low profile or deployability. While the EW Squadron complete can provide effective EW support for up to a division or two brigade group sized deployments simultaneously,[29] deployments are based on case-by-case assessment of mission requirements and the EW target environment.

21. There are two broad organizational paradigms for EW employment:

a. light EW, and

[29] Simultaneous deployment of both troops must take into consideration issues such as sustainment.

b. heavy EW.

LIGHT EW

22. Light EW assets have the full spectrum of operational capability and are mounted in wheeled soft-skinned vehicles thus having the ability to operate dismounted to a limited degree. Logistical limitations of the platforms employed may dictate a slightly degraded capability that is offset by increased mobility and reduced logistical support requirements.

HEAVY EW

23. Heavy EW assets are equipped with wheeled armoured sensor platforms. Heavy EW may have an increased technical capability due to the increased load-carrying capacity of the platform and provide increased operator protection. Heavy EW has increased logistic support requirements.

SECTION 10
ORGANIZATION: FORCE EMPLOYMENT

24. For all deployments, subject to resource constraints and based on the assigned mission, the EW team/detachment/troop/squadron will be formed on a grouping of the fol building block functions/entities:

a. EWCC or SEWCC;

b. EWOC or SEWOC;

c. EWLO;

d. mobile EW team (MEWT);

e. ECM; and

f. CSS.

A MEWT is a grouping of EW capability, usually ESM, at the lowest level, formed to meet a mission requirement. It can be an existing ESM detachment, an ESM detachment augmented with intelligence analysis capability or a grouping of both an ESM and ECM detachment together. A MEWT grouping is mission dependant.

25. The EW Squadron complete would normally deploy the following:

a. a main and alternate SEWCC—this depends if there is an alternate formation headquarters;

b. one or more EWLO detachments;

c. a main and alternate operation centre (SEWOC) to provide a firm base for continuous search, intercept, analysis and communications DF tasking;

d. two light and/or heavy ESM baselines of normally four detachments each, including a mobile detachment specializing in EW/spectrum reconnaissance;

e. four ECM/jamming detachments; and

f. a CSS echelon.

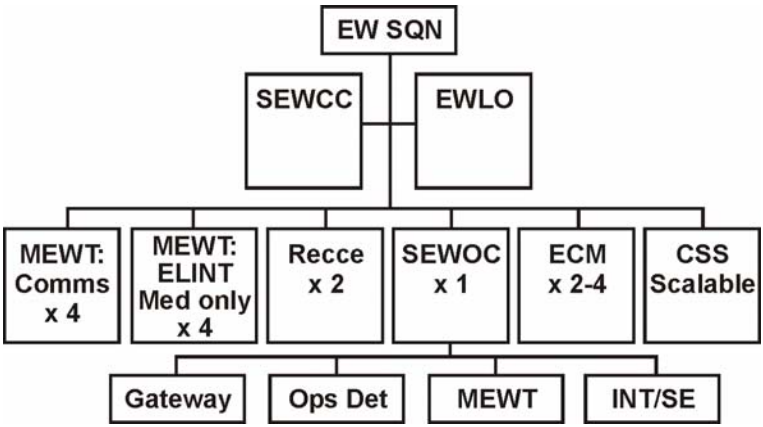


Figure 2-5: EW Squadron Deployment Order of Battle

26. As deployments can be scaled to specific mission requirements, the total number of options is extensive. The following list of examples is not exhaustive:

a. **EWLO**. Small-scale short-term deployments, such as a non-combatant evacuation operation (NEO), might be provided with a single vehicle (or man-pack) detachment, which is capable of providing

EW liaison, advice, connectivity to national or allied assets and a limited capability to perform ESM.[30]

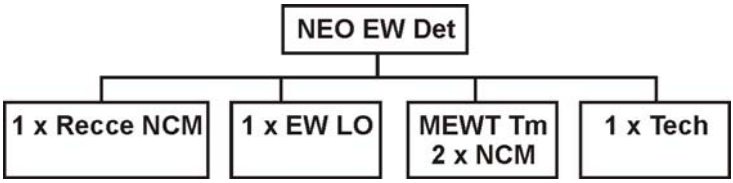


Figure 2-6: NEO EW Team

b. **EWCC/MEWT**. A two- or three-vehicle grouping capable of providing EW liaison, advice and connectivity to national or allied assets, a full-time presence at the ISTAR table if required, and a team capable of mobile ESM operations, either vehicle-mounted or foot borne, to carry out EM spectrum reconnaissance and provide target situational awareness and threat warning to the supported commander.

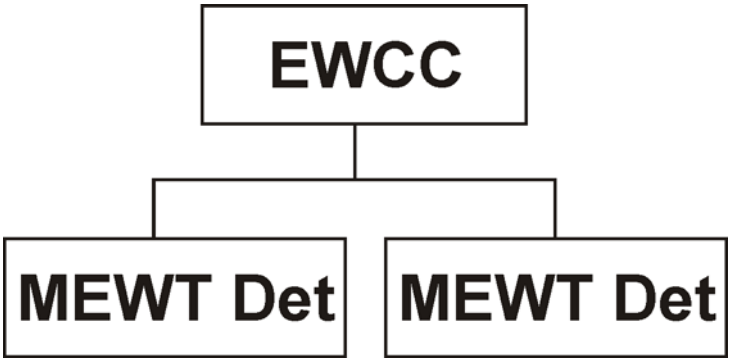


Figure 2-7: EWCC/MEWT

c. **Rapid Deployment Troop**. EWCC, EWOC, one EWLO team (capable of acting as EWOC alternate), a wheeled vehicle baseline capable of full spectrum

[30] The level of ESM that can be provided by a single detachment is limited to essential force protection and short-term warning.

ESM and limited ECM and integral specialist technical support.

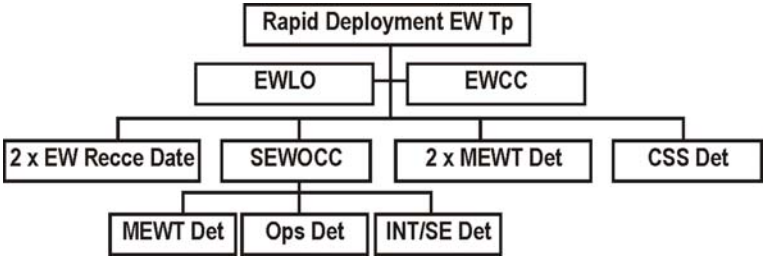


Figure 2-8: Rapid Deployment EW Troop

CHAPTER 3
COMMAND AND CONTROL OF ELECTRONIC WARFARE

SECTION 1
GENERAL

1. When speaking of command and control of electronic warfare (EW), this normally refers to specialist EW units/detachments within formations. Electronic warfare units provide formation commanders with capabilities to conduct EW support measures (ESM) and electronic countermeasures (ECM) operations. All units and formations conduct electronic protective measures (EPM) with EW units providing specialist advice. Electronic warfare must be coordinated centrally at each level of command. This does not prevent the allocation of EW capabilities to subordinate formations and units. Internal to an EW unit, command and control is exercised via two distinct entities—the EW coordination cell (EWCC), which exercises command on behalf of the EW unit commander, and the EW operations centre (EWOC), which exercises operational control of the EW assets in accordance with command direction.

SECTION 2
COMMAND OF EW

2. Electronic warfare unit commanders exercise command over their organic EW assets and, depending on the command relationship,[31] exercise control (on behalf of the commander) of additional EW assets assigned. The EW commander is also the arms adviser to the commander on EW matters.

3. The EWCC is located at the tactical headquarters and acts as the EW unit commander's ops staff. This coordination is primarily in the form of direction with regard to movement and allocation of EW assets in support of specific units during different phases of formation operations.

[31] B-GL-300-003/FP-000 *Land Force Command* provides details of various command relationship under which forces can be assigned.

SECTION 3
ELECTRONIC WARFARE COORDINATION CELL

4. The EWCC is the focal point for all EW activities within a given level of command. The supporting EW unit normally provides the EWCC. Each level of command that has EW assets allocated will have an EWCC. The EWCC performs the following functions:

a. develop the EW plans to support the commander's operation and intelligence, surveillance, target acquisition and reconnaissance (ISTAR) plan;

b. coordinate ESM and ECM activities with other combat capabilities within the formation;

c. coordinate ESM and ECM activities with higher and flanking formations;

d. provide specialist EW advice to the commander and other staff, including EPM;

e. direct ESM and ECM activities on behalf of the EW commander;

f. control ECM operations on behalf of the EW commander;

g. provide ESM results in support of the ISTAR system; and

h. provide EW operational support (EWOS[32]) through liaison with higher and national level organizations.

5. Coordination of EW activities across various levels of command is critical. This prevents the duplication of effort and enhances the sharing of EW information. The chain of command takes precedence over any EW technical control. The senior formation EWCC has technical control of all EW activities. Figure 3-1 illustrates the parallel chain of command and control within a solely national context.

[32] EWOS consists of the provision and maintenance of EW databases in support of EW operations undertaken by the Land Integrated Support Station (LISS).

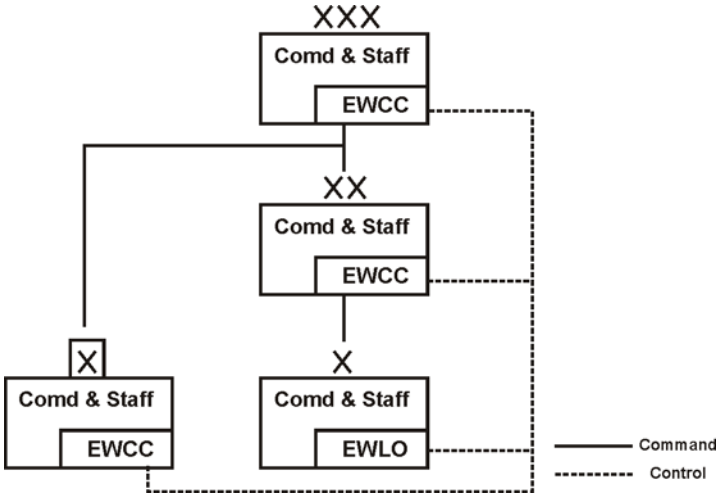


Figure 3-1: EW Coordination

6. In the context of joint and multinational operations, the same technical control relationship would occur. The joint EWCC would exercise technical control over the Land component EWCC (as well as those of the Air and Maritime elements). Canadian LF formations will normally be allocated to an allied formation for operations. The allied formation EWCC is responsible for the coordination of all EW activities within the formation. Technical control and passage for EW information to other nations will be based on national agreements and policies. Figure 3-2 is illustrative of this arrangement from a NATO context.

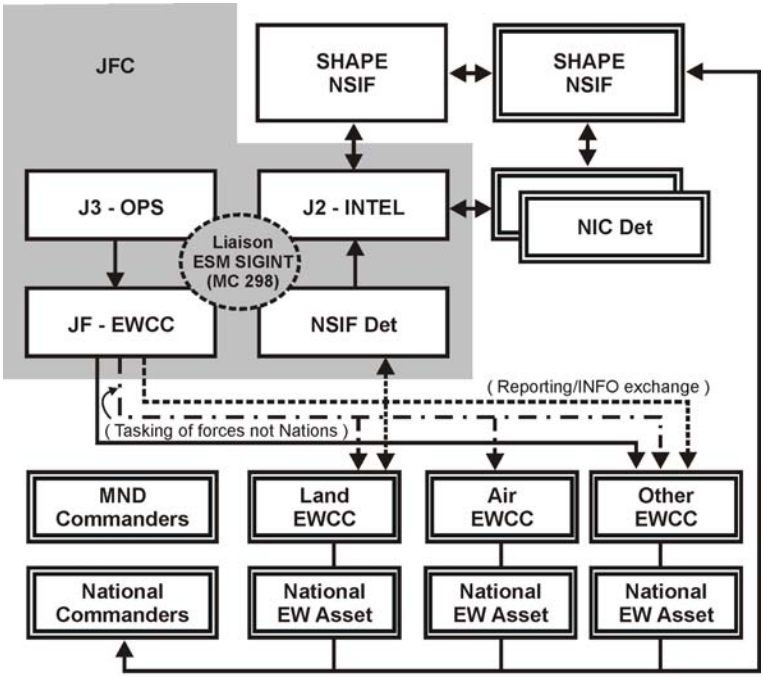


Figure 3-2: JFC EWCC Integration and Relationships

ELECTRONIC WARFARE OPERATIONS CENTRE

7. As previously stated, the EWOC exercises operational real time control of the formation EW capability specifically with regard to ESM in accordance with the EW unit commander's direction. The primary function of the EWOC is to control the ESM system as it executes search, intercept and direction-finding tasks. It should be noted that an EWOC could vary both in location and manning. In the traditional sense the analysis function is centrally collocated with an intercept capability to form a large EWOC complex separate from both ESM baselines and the EWCC. With the formation of mobile EW teams (MEWTs) with analysts pushed forward into ESM location and exercising first level analysis of forward search, intercept and DF, the paradigm of the EWOC as a centralized physical entity needs to be reconsidered. With the deployment of MEWTs, the EWOC is more a dispersed function then a centrally located detachment. As a physical

grouping, albeit with reduced manning, the EWOC will always exist. However, with the deployment of MEWTs, it is likely to collocate either with the EWCC or with the all source cell at formation HQ. Ground truth will dictate the implemented EWOC solution. Note the addition of a satellite support element (SSE) capability to an EWOC renders it a SEWOC.

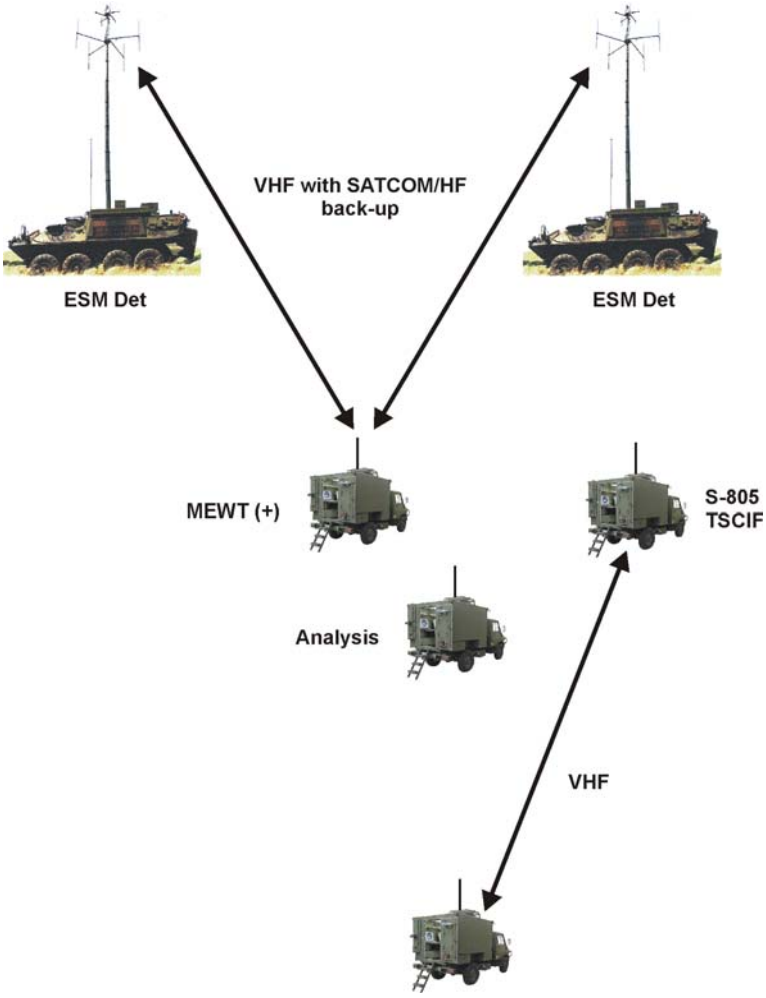


Figure 3-3: Centralized SEWOC Deployment

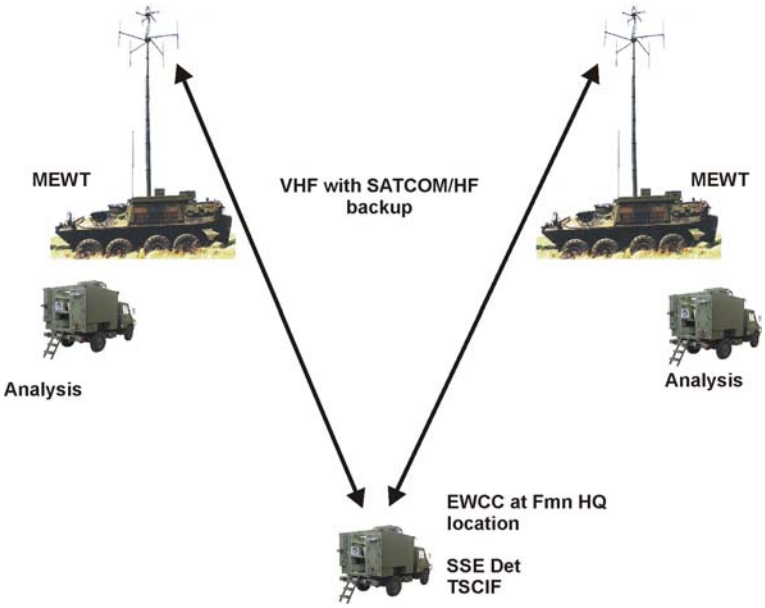


Figure 3-4: Dispersed SEWOC Deployment with Fwd Search, Intercept, DF and Analysis

ELECTRONIC WARFARE LIAISON OFFICERS

8. Electronic warfare liaison officers (EWLOs) are normally allocated from the formation EW unit to subordinate formations that do not have an organic EW unit. The purpose is to allow subordinate formations and units access to the capabilities of the EW system, in particular, ESM information and ECM. If a subordinate formation is allocated EW resources, an EWCC is provided to support that formation headquarters.

CHAPTER 4
THE OPP, IPB, TARGETING, ISTAR AND EW PROCESSES

SECTION 1
THE OPERATIONAL PLANNING PROCESS

1. Formation headquarters (HQs) use the operational planning process (OPP) to produce a plan based on the mission, concept and intent of the higher commander. The intelligence preparation of the battlefield (IPB) process and the targeting process support the OPP. The OPP is a six-step process:

a. **Receipt of Tasks**. The formation HQ normally receives its tasks as a warning order, operations order or fragmentary order from the higher formation. The receipt of the tasks initiates a new planning cycle.

b. **Orientation**. In this step the commander conducts his mission analysis and prepares his guidance. The commander's guidance will include commander's critical information requirements (CCIRs). Priority intelligence requirements (PIRs) are the component of CCIRs that provides guidance to the overall intelligence, surveillance, target acquisition and reconnaissance (ISTAR) effort and by extension the electronic warfare support measures (ESM) effort.

c. **Develop Courses of Action**. The staff develops courses of action (COA) based on the information. The IPB process develops possible adversary COA and questions for the ISTAR system. The staff then compares COA by means of a war game. The electronic warfare coordination cell (EWCC) would support the ISTAR system in helping to answer questions from IPB by directing ESM activities and obtaining any available signals intelligence (SIGINT) from other sources.

d. **Decision**. The staff presents the results of COA war game to the commander for a decision on which COA to develop into a plan.

e. **Plan Development**. Another war game is conducted to refine the selected COA and develop the decision support template (DST), the

synchronization matrix and high payoff target list (HPTL). The targeting process produces the attack guidance matrix (AGM). The EWCC supports the targeting process with coordination of electronic countermeasures (ECM). The result of this step is the production of an order.

f. **Plan Review**. The coordination of the details of the plan with subordinate units is conducted during this step. The EWCC coordinates the electronic warfare (EW) plan with higher and lower formations as necessary.

SECTION 2
ELECTRONIC WARFARE AND THE INTELLIGENCE PREPARATION OF THE BATTLEFIELD PROCESS

2. The IPB process provides a continuous analysis of the adversary, weather and terrain. The result of the process is the information collection plan (ICP). The process has four steps:

a. **Define the Battlefield**. The staff refines the area of operations (AO) and defines the area of intelligence responsibility (AIR) based on the higher formation orders and the commander's initial planning guidance.

b. **Describe the Battlefield Effects**. The G2 collects information about the battlefield or updates information provided by other sources. The effects of terrain and weather on the AO are also evaluated.

c. **Evaluate the Threat**. The G2 assembles all available information on the adversary and prepares doctrinal and event templates.

d. **Determine Threat COA**. The G2 prepares threat COA based upon the available information.

3. The EWCC does not normally participate in IPB, however, the IPB product, the ICP, provides direction to the EWCC for ESM through the ISTAR CC. If required, the EWCC would provide advice on the employment of ESM assets to support the ICP. The IPB process is a useful tool for the EWCC in preparation for ESM operations.

SECTION 3
ELECTRONIC WARFARE AND THE TARGETING PROCESS

4. Targeting is defined as "the process of selecting targets and matching the appropriate response to them taking account of operational requirements and capabilities."[33] The targeting process assists the commander by determining which targets are to be acquired and attacked, when they are to be attacked, and what is required to defeat the target. A target is an adversary function, formation or equipment, facility or terrain planned for destruction, neutralization or suppression in order to delay, disrupt, divert, limit or destroy the adversary.[34] Targeting links the commander, the sensors and the engagement systems. The targeting process has four functions:

a. **Decide**. Decide is the cornerstone of the targeting process and requires close coordination between the commander and the intelligence, plans, operations and targeting team elements. The process begins with receipt of a mission, whether assigned by higher headquarters or deduced by the commander. The commander, with input from his staff, analyses the mission and considers the tasks that must be performed. Targeting priorities must be addressed for each phase or critical event of an operation.

b. **Detect**. Detect is the next critical step in the targeting process. The G2 is the main figure in this step as he coordinates the effort to detect high payoff targets (HPTs) identified in the decide function. To ensure there is no duplication of effort, specific direction is given to target acquisition systems capable of detecting high priority targets. Information needs are expressed as priority intelligence requirements (PIRs) and information requirements (IRs). The detect function is carried out through the execution of the ICP.

c. **Deliver**. The deliver function of the targeting process executes the AGM and supports the commander's battle plan once the HPTs have been

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[33] AAP 6 *NATO Glossary of Terms and Definitions.*

[34] B-GL-300-007/FP-001 *Firepower* Chapter 3.

located and identified. During the detect function, it is the target acquisition (TA) assets that have to be managed. The deliver function provides the framework for the efficient employment of firing assets. The attack of targets must satisfy the attack guidance developed during the decide function.

d. **Assess**. Combat assessment is the determination of the effectiveness of force employment during military operations. It is composed of three elements as follows:

(1) **Battlefield Damage Assessment (BDA)**. BDA is the timely and accurate assessment of damage resulting from the application of military force, either lethal or non-lethal, against a target. It provides commanders with an estimate of the adversary's combat effectiveness, capabilities and intentions.

(2) **Munitions Effect Assessment (MEA)**. This is used as the basis for recommendations for changes to increase the effectiveness of tactics, methodology, weapon system selection, munitions and weapon delivery patterns.

(3) **Recommendations for Re-attack**. This aspect considers the requirement for another attack if the desired effect on the target has not been achieved.

5. The EW system is involved in the targeting process in two ways. Firstly, ECM is integrated as an "engagement system" with all of the other engagement systems at the commander's disposal. The EWCC, which is a member of the targeting team, is responsible for the integration, tasking and control of ECM based on the targeting priorities. The second way that the EW system is involved in the targeting process is that the entire EW system is required to conduct its own targeting process for effective ECM support.

6. The EWCC with the targeting team conducts the decide function for ECM. The targeting team will recommend the use of

ECM and the control measure[35] to be in effect. The ESM provides the detection function for ECM. This involves the collection of information (in effect target acquisition) in sufficient detail to allow for effective ECM. For example, determination that a specific frequency is an artillery net and its general direction is sufficient information to allow the EWCC to target that particular net. The deliver function is conducted by the ECM detachments as directed and coordinated by the EWCC. The ESM then provides the assess function by determining if the ECM has been effective and recommends new targets to the EWCC to ensure the ECM remains effective.

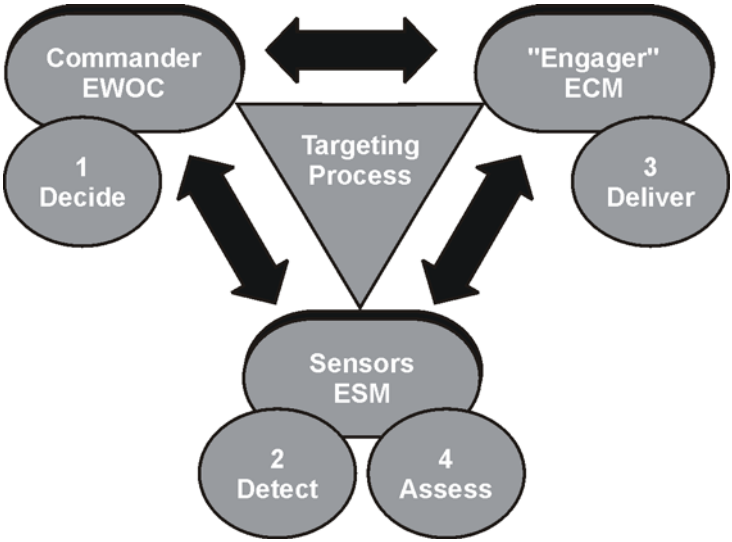

Figure 4-1: EW in the Targeting Process

SECTION 4
THE ISTAR PLANNING PROCESS

GUIDANCE

7. The ISTAR planning process within the formation is a continuous process much like IPB and targeting. A cycle begins with the receipt of the commander's guidance on completion of his mission

[35] See chapter 6 for ECM control measure measures.

analysis. The guidance contains the PIRs that are of concern to ISTAR.

PRIORITY INTELLIGENCE REQUIREMENTS

8. At this stage in the process, PIRs should be considered to be of two types. Some PIRs are things that the commander will need to know for the execution of the mission. For example, the commander may want to know if the adversary will delay or defend. As a result, during execution, ISTAR will look for indications that the adversary is thinning out in preparation for a withdrawal. Other PIRs will be for planning. For example, the commander may want to know the extent to which the adversary's defences have been prepared. These latter PIRs are immediately translated into tasks in the ISTAR coordination centre (ISTAR CC) and issued out to sensors. The EWCC converts tasks from the ISTAR CC into ESM tasks.

INTELLIGENCE PREPARATION OF THE BATTLEFIELD

9. Intelligence, surveillance, target acquisition and reconnaissance provides the terrain and environment information that allows the G2 to describe the battlefield effects. The ISTAR CC also contributes to the evaluation of the threat by providing intelligence from existing databases and from the results of the collection efforts resulting from the PIRs issued for planning.

OPERATIONS PLAN DEVELOPMENT

10. As the formation operations staff develops the COA, ISTAR planners contribute to the development by advising on the ISTAR contribution to each COA. The ISTAR planners participate in the COA war game and the plan war game in order to ensure that ISTAR tasks are fully synchronized with the remainder of the plan.

11. During plan development, the ISTAR CC continues to contribute to the common operational picture, as it collects information based upon the PIRs issued for planning. The updated common operational picture allows the COA to be adjusted to a change in adversary disposition or in increase in our knowledge of the adversary disposition.

SECTION 5
ISTAR PLAN

12. The ISTAR plan is included as an annex to the formation operation order. Like the Fire Support annex, the ISTAR plan is prepared by the ISTAR CC and is issued as part of the formation operation order. The ISTAR plan describes how the assets of the ISTAR system will be used to collect the information required in the ICP.

13. The ISTAR CC will coordinate unit ISTAR plans on behalf of the G3 ISTAR. This will identify gaps in the ISTAR coverage and allow action to be taken to cover the gaps if possible. It will also identify to the ISTAR CC, the ISTAR priorities of subordinate commanders, so that information that is collected that is particularly relevant to their battles can be processed on their behalf. The EWCC will assist in this coordination by evaluating the ESM coverage of a subordinate formation.

14. **ISTAR Overlay**. The ISTAR overlay links the ISTAR plan, IPB and the targeting process. The overlay details the named area of interest (NAI) and target area of interest (TAI) that are developed during the formation OPP. Collection tasks within these NAI and TAI will be detailed in the ISTAR annex and the ISTAR matrix.

15. **ISTAR Matrix**. The ISTAR matrix is an appendix to the ISTAR annex. It is based upon the ICP produced by the G2. The ISTAR matrix relates the ICP to the ISTAR system sources and agencies. It identifies collection tasks to ISTAR sensors and is prepared by the ISTAR CC. The EWCC will be represented on the ISTAR matrix and is the main tasking document for ESM. It also allocates tasks to other formation units since it forms part of the formation operation order.

16. **Information Collection Plan**.[36] The ICP identifies the PIRs, the IRs and the combat indicators necessary to evaluate the adversary's COA and to predict the adversary's future activities. It is an appendix to the Intelligence annex to the formation operation order. It allows all units to understand the information required to draw the appropriate conclusions about the adversary. This is a very important

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36 Examples of the ISTAR overlay, ISTAR matrix and the ICP can be found in B-GL-352-001/FP-001 *Land Force Information Operations—Intelligence, Surveillance, Target Acquisition and Reconnaissance* Chapter 3.

document for the EWCC and the EW analyst. It allows the EWCC to focus its analytical efforts. Conclusions drawn by the analysts must support PIRs and IRs.

SECTION 6
THE EW PROCESSES

17. **There is not one EW Process**. The EW system conducts two processes: ESM and ECM processes. The EWCC is the focal point of both of these processes.

18. **The ESM Process**. The ESM process is a sub-process of the ISTAR and intelligence processes. The ESM process mirrors the intelligence cycle in that it consists of direction, collection, processing and dissemination. The process begins with direction from collection management on the areas to be covered. This consists of the ICP, ISTAR overlay and ISTAR matrix. The EWCC converts these documents into specific targets such as networks (C2, artillery, reconnaissance nets), critical nodes (command posts, communication centres) and activities (radar, movements) that will satisfy the collection tasks. The targets are passed to the EWOC for additional analysis, refinement and tasking to the sensor systems. The sensors, both COMINT and ELINT, conduct the collection phase of search, intercept and direction finding (DF). The search systems continuously look for targets and pass those of interest to intercept for further detailed collection. Direction finding is conducted to determine locations, and this information is fused with the intercept information. The EWOC analysis detachment then processes the information into a “single source” intelligence product (SIGINT) disseminated in the form of TACREPs or EWSUMs. The EWOC can also re-task the sensors as necessary. The products are then disseminated to the EWCC who provides the results to the all-source centre. The ASC may ask for additional information from the EWCC or request additional ESM tasks through the collection managers to the EWCC.

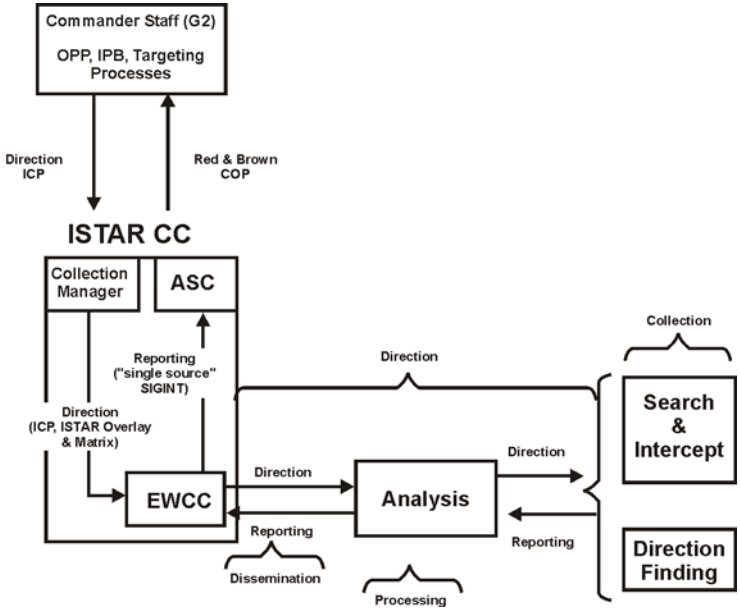

Figure 4-2: ESM Process

19. **The ECM Process**. The ECM process is a sub-process of the targeting process. The EWCC receives ECM tasks through the attack guidance matrix (AGM), which is developed by the targeting team and approved by the commander. This process also provides additional ESM collection tasks that the EWCC must direct to the EW system. The ESM provides the detection (target acquisition) system for ECM. The ESM system must provide detailed information to allow ECM to be effective. The results of detection are provided to the EWCC to allow for the integration of ECM into the fire support plan. The G3, through the fire support coordination centre (FSCC), then authorizes ECM. The EWCC then tasks ECM elements to conducts attacks. The ESM then monitors and provides an assessment of ECM effectiveness to the EWCC. This ECM assessment is provided to the targeting team who start the process again.

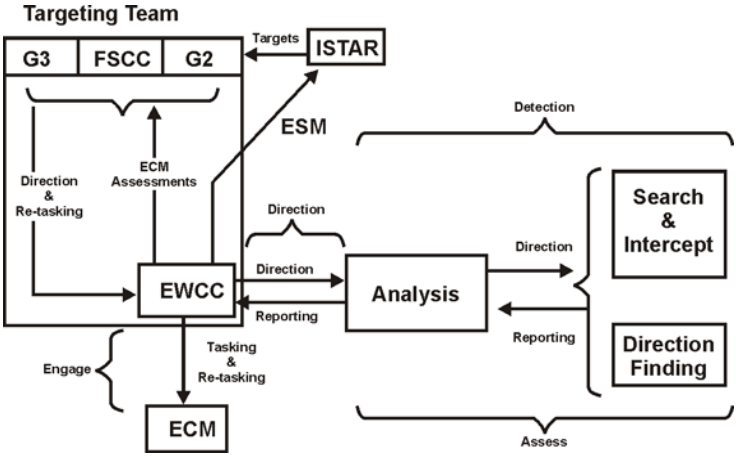

Figure 4-3: ECM process

20. The conduct of ECM will have a direct effect on the ESM collection. The ESM resources normally dedicated to ESM tasks will be required to monitor the effects of ECM and will thus cause some degradation of the ESM effort. Normally, many of the ECM targets have been well developed and, therefore, the ESM effort will not be completely degraded to support ECM. Electronic warfare support measures should continue during ECM activities. If necessary, the G3 ISTAR will make the decision on the priority of effort based on advice from the EWCC and the G2.

CHAPTER 5
ELECTRONIC WARFARE SUPPORT MEASURES

SECTION 1
GENERAL

1. Essentially electronic warfare support measures (ESM) are the exploitation of adversary transmissions for the purpose of providing immediate threat warning, signals intelligence (SIGINT) about the area of interest and targeting information for electronic countermeasures (ECM). Electronic warfare support measures are composed of search and intercept, direction finding (DF) and analysis functions applied against communication and non-communication targets. The ESM process is described in chapter 4 and mirrors the intelligence cycle. Electronic warfare support measures can be carried out from ground-based equipment in the forward area and at greatly extended ranges from airborne platforms. All electromagnetic (EM) radiation has a distinct characteristic or signature, ranging from a single radio frequency to the unique signature of an air defence radar/weapon system. Electronic warfare (EW) units deploy electronic sensors so they can listen to, locate and identify adversary transmissions.

2. Electronic warfare support measures (except for organic communications systems) employ passive sensing. In general, ESM can collect information throughout a commander’s area of interest and they are an all weather capability. Ranges and accuracy (DF) of ESM are greatly increased with the use of elevated platforms. It is unlikely that the land forces would obtain dedicated platforms such as helicopters and unmanned aerial vehicles (UAVs) dedicated to EW use. However, ESM equipment needs to be modular and compatible to allow for deployment in these platforms. Electronic warfare support measures require special equipment, well trained soldiers and clear direction from the intelligence, surveillance, target acquisition and reconnaissance (ISTAR) process on priorities, the types of targets sought and the kind of information desired so wasted effort is prevented.

3. To exploit the adversary's transmissions, EW elements search the spectrum to find which frequencies the adversary is using. When they find a target frequency, or set of frequencies in the case of frequency agile systems, they then intercept the transmissions, use DF equipment to locate the transmitters and then analyse the message

content or emission types to gain information and disseminate the information to anyone who requires it.

SECTION 2
SEARCH AND INTERCEPT FUNCTION

4. Search and intercept should be considered electronic reconnaissance and electronic surveillance. In general these two functions cannot be separated as the same equipment and operators do both functions. In the past, search was viewed as the start of the EW process, however, it is unlikely that deployed land forces will arrive in a theatre without some national SIGINT database support allowing for immediate commencement of intercept tasks.

5. **Search**. The search function based on SIGINT already available conducts a reconnaissance of the EM spectrum for exploitable activity. Search must be conducted continuously, and some resources will always need to be dedicated to it. Analysis of the results of the search function is very useful in determining adversary activity even if the internal information of the communications cannot be immediately exploited.

6. In the early stages of an operation, search operations are vital to providing the information necessary for development of the overall ESM capability. The results of search provide detailed information on the portions of the EM spectrum employed by an adversary and from this allow the ESM package to be task-tailored to exploit the particular theatre. This is particularly important in operations other than war (OOTW), where the size of the EW force will be limited by the overall contingent size.

7. Search operators are required to exploit as much of the EM spectrum as possible. This will include HF, VHF, UHF, SHF and EHF bands for communications and radar activity. The general search operator, who has some knowledge of the target language, records all voice transmissions heard. The operator notes the frequency, the type of modulation and the mode of transmission. If the net is operating in plain language, the operator can log the call signs, the type of net and an outline of the traffic. If the operator recognizes it as an important net, the operator calls for another operator to look specifically at that particular frequency. In the case of non-communication transmissions, general search operators are looking for emissions with unique signal characteristics before conducting follow on direction finding and analysis.

8. The operator involved in a specific search carries out the task in the same way as the general search operator. The operator will be assigned to specific frequencies and looks for specified nets. Following a frequency change, the operator will be busy trying to rediscover the net on its new frequency. Details of priority nets and those which show promise of providing useful information are then passed to an intercept operator. Modern search equipment incorporates microprocessors, which can be programmed to automatically scan a portion of the band, ignoring friendly or restricted frequencies.

9. **Intercept**. While the search function conducts a reconnaissance of the EM spectrum, the intercept function conducts surveillance of specific target frequencies. The aim of intercept is to exploit the specifics of adversary transmissions, primarily by transcribing unencrypted voice transmissions, facsimile and data. These activities require very specialized operator skills such as linguistics. Once an important radio net is identified by search, it is handed off to an intercept operator who records the information passed on that net. The intercept operator exploits the information on the net to the extent possible and then passes the results to analysts for further exploitation, fusion and reporting. The intercept operator passes the tapes and log to the analyst in the form of data files. The same process is conducted with regard to intercept of non-communication emitters.

10. Many signals will not be immediately exploitable. These signals will be recorded, logged, databases updated and passed to other EW assets for exploitation. In certain instances, the support of coalition national agencies will be necessary to exploit these signals. The process of exploitation in this case must be as fast as possible to ensure the commander is supported with timely strategic SIGINT. However, when an immediate threat is identified, a warning in the form of a tactical report (TACREP) is reported directly to the electronic warfare coordination cell (EWCC) / all-source cell (ASC) for furtherance to the targeted unit.

11. Intercept can be conducted against secure and insecure nets, but the information obtained will vary. Secure targets yield valuable information in the form of emission characteristics (e.g., frequency and modulation), and some inference can be drawn about the relative importance of the net based on traffic patterns and location of stations. Secure stations are still subject to DF, as are stations working insecure.

12. From intercept the analysts receive information about frequency, message content, traffic flow, activity patterns and

transmission types. This information is enhanced by locations and movement provided by DF. In conjunction with other sources of intelligence, the analyst will try to determine the adversary order of battle, strengths, intentions, unit identities and deployment.

13. **Search and Intercept Equipment**. The fundamental equipment in any search and intercept system is the receiver and associated antenna. Intercept receivers are very sensitive with a high degree of frequency accuracy and stability. With a high gain antenna and good siting, receivers are capable of exploiting signals at a greater range than normal communication receivers. Intercept receivers usually incorporate a digital frequency meter, which gives the operator a precise frequency read-out for use by direction-finding stations. They also have a panoramic display that can detect all transmissions within a certain range even if these transmissions are infrequent or short.

SECTION 3
DIRECTION FINDING

14. Direction finding is an ESM function that provides location information on target emitters. This information when fused with other search and intercept information is invaluable. Direction-finding equipment is a receiver with a specialized antenna system that is capable of providing a line of bearing (LOB) to where the emitter is located. The quality of the DF system, terrain, signal strength and reflection determines the accuracy of the LOB. The accuracy of current systems is in the range of one to three degrees. Current systems determine the location of an emitter by triangulation. Three or more direction-finding stations are used along a baseline, each taking a LOB on the target station transmission simultaneously. At a regular operating range of a DF baseline—15 km or 20 km—this equates to an accuracy or circular error probability (CEP) of approximately 1000 m. It is for this reason that DF alone cannot yet be regarded as a target acquisition system for fire support. However, ESM data including DF provides excellent cueing for other sensors to detect targets with sufficient accuracy to target. Increasing the number of bearings obtained and using elevated DF platforms can improve DF accuracy. Additionally, DF accuracy tends to improve when targeting higher frequencies. As technology advances, we can expect in the future that locating emitters will improve significantly. Current electronic intelligence (ELINT) DF systems have an accuracy of $1/10^{th}$ of a degree. It is expected that this will provide targets within 100 m at ranges of up to 20 km.

15. **Emitter Density Location**. A number of secure and insecure transmissions on different frequencies all emanating from the same area may indicate the location of an important headquarters. In any formation, each type of unit or level of headquarters will have its own distinctive electronic signature, which, if identified and located, will obviously provide vital intelligence. The interrelationship between stations on a net and their locations is an important element in establishing the adversary's electronic order of battle.

16. In the near future it can be expected that search, intercept and DF functions will be conducted from the same platform. Integration of intercept and DF information will thus be greatly improved, and a large analytical effort to fuse this information will be reduced. This will result in combined ESM detachments for search, intercept and DF. Current ELINT systems already have an integrated search, intercept and DF capability.

17. In the HF frequency band, “single station location” can be done. In effect the target emitter is located by a single ground station and not by triangulation with a deployed baseline. Again, it is expected that in the near future, this type of locating capability will be available in other bands a well. In essence, the need to deploy a baseline to obtain accurate DF information will be reduced. This will have particular application in OOTW, where a limited number of EW systems can be deployed, and in situations where it is not practical to deploy baselines.

18. Ground-based detachments must be located in forward areas and sited to obtain a good electronic view of the adversary emitters (usually line of sight). As with search and intercept equipment, DF equipment benefits from elevated platforms via UAV and aviation assets. This greatly improves the accuracy and range over ground-mounted systems but is limited by the availability of platforms and weather. Direction finding via elevated platforms should augment a ground-based capability.

SECTION 4
ANALYSIS

19. Analysis is a process of taking sensor data and converting it into information that is useful. It is important to understand that analysis occurs throughout the ESM process and not just as a final step. The key principles in analysis that apply to ESM are accuracy and speed. The outputs from analysis are SIGINT, immediate threat

warnings, ECM targets and assessments of the effectiveness of ECM and other IO measures such as PSYOPS or deception.

20. Specially trained SIGINT analysts primarily carry out the analysis function. The analyst takes direction (priority intelligence requirement) from the EWCC and converts this into tasks for the ESM sensors. The ESM sensors then collect the necessary data and information and provide them to the analysts. The analysts then take the sensor results, use various databases and produce their products. The analyst must integrate information from search, intercept, and DF of communication and non-communication emitters and produce a SIGINT view of the battle. From an all-source cell perspective, SIGINT is considered a "single source" that must be integrated with other sensor information (recce, UAV, HUMINT) to produce Red situational awareness (SA) for the commander.

21. Accuracy of the products is critical. The ESM process must produce reliable information and be able to indicate to the ASC how accurate the information is. Inaccurate information can have a detrimental effect on the entire process of producing Red SA. Speed of reporting requires the ESM process to produce accurate results as quickly as possible. This allows the commander to have Red SA faster and hence enables him to quicken his decision-action cycle relative to the adversary's.

22. With software and databases being part of ESM systems, software can compare ESM results to known databases and provide instantaneous analysis of a signal. This is particularly true in ELINT. Radars are detected, characterized, located, identified and reported without necessarily having a human interface. This level of analysis converts signal data into useful information. Search and intercept operators conduct analysis based on knowledge of the adversary systems. In principle, the analysis should be done as quickly as possible using integral software and operator knowledge. As analysis and data fusion software develops, ESM equipment and operators will conduct more analysis. Analysis is a time consuming process. The adversary uses many means to ensure that it takes considerable time to produce results.

23. From intercept, the analysts receive information about frequencies, call signs, types of net, message content, traffic flow, activity patterns and transmission types. For both radio and radar, intercept can identify the equipment by its technical characteristics (electronic fingerprinting). When fused with locations and tracks from DF, this information enables the EW analyst to build up the adversary

electronic order of battle. The result of their efforts will be intelligence concerning the adversary order of battle, strengths, intentions, unit identities and equipment developments. Some information cannot be held by the analyst while developing SIGINT since it is time perishable and therefore must be passed immediately to the EWCC/ASC for action. The analyst is a detective and quickly seizes upon any errors or breaches of security. The building up of an overall SIGINT picture by analysis is a lengthy process. If the adversary EPM is effective, SIGINT obtained by intercept is fragmentary at first and gains coherence only as a result of close observation over a period of time.

24. **Location of Analysis**. Many factors dictate the location of the analysts. Factors that would determine the location of the analysis function are:

a. **Continuity**. ESM analysis needs to be continuous. When there is a period of time that analysis is not being conducted, gaps in knowledge are created that will directly affect the accuracy and speed of reporting. The analysis function needs to be as stationary as possible, have redundant capabilities or a split based capability.

b. **Access to Databases**. The analysis function requires access to databases both for SIGINT and other intelligence information. The databases provide quick references to previously conducted activities and greatly speed the analysis process.

c. **Communications**. Limitations in the size of communications links may require analysts to deploy directly with the sensors. In other cases, the communication may allow for the analyst to be physically separated from the sensors but in virtual contact. The analysis function must have reliable communication with the ESM sensors. The commander must always have some analysis capability in theatre to allow for time of communications disruptions.

25. Traditionally the analysis function has been co-located with the search and intercept functions. Tactical communications has normally been conducted with low bandwidth tactical radios. The analyst had to reduce the amount of information passed to a size that

could be routinely transmitted by that means. The arrangement also allowed for a close relationship between intercept and analysis. Current communications technology will soon allow a far more flexible deployment of the analysis function. In recent operations, both sensor and analysis functions have been conducted in separate locations over strategic distances. Additionally, the analysis function has been integrated with ESM sensors into a single vehicle detachment on occasion. This demonstrates that the location of the analysis function is flexible and mission dependant.

26. Within the ISTAR CC there will likely be a need to have SIGINT analysis capabilities. This will create a synergy with the ASC and the other sensors. As well, national level communications links will be readily available to the analysts.

27. **Analysis Security**. Many SIGINT databases and analytical methods are highly classified and specially protected. This creates a requirement for a special compartmented information facility (SCIF). Access to the information and many SIGINT products require special security clearances. Commanders, designated staff and the ISTAR CC will require regular access to this information and will need to be cleared appropriately.

28. **Dissemination of Analysis Products**. Analysis derived products will be disseminated on a need to know basis. In general, the products will be sanitized to allow them to be passed on the Land Force command and control information system (C2IS) systems. The sanitation procedure will be in accordance with nationally set guidelines and the source protection necessary. The normal products of the EW process are:

a. **Tactical Reports and Summaries**. These reports are produced in an approved text format that allows for quick dissemination, database updates and display on maps as necessary.

b. **Overlays**. Overlays allow for a pictorial representation of various ESM results. For example, all air defence radars, and all or selected DF results.

29. **Enemy Electronic Deception verses Analysis**. Analysts must be aware that an adversary may attempt deception. A properly conceived deception plan is aimed at the commander not the ESM system. An electronic deception is normally planned as part of an overall deception plan. In some instances, however, it is possible for only an electronic deception to be attempted. In this case, the aim is to

deceive the ESM system into reporting false information that will be reported to our commander. Analysts must be aware that deception is possible and question results that appear unusual. When this occurs, the ISTAR system may be able to confirm or deny the adversaries use of deception with other sensors. Analysts should not be over cautious and not report for fear of deception.

30. **Conclusion**. As discussed before, automated tools will significantly speed up the analysis process. Analysts must still be highly skilled in order to quickly make sense of a myriad of data. Although progress in the areas of artificial intelligence and automated tools is constantly being made, the main tool remains a highly skilled analyst.

SECTION 5
ELECTRONIC INTELLIGENCE ELECTRONIC WARFARE SUPPORT MEASURES

31. **ELINT ESM**. The previous paragraphs describe the ESM process—consisting of intercept, search, DF and analysis—and the application of these sub-processes against communication-based emitters. It should be re-emphasized that the same ESM process is applied against non communication-based emitters and results in an ELINT product. Each radar has a characteristic frequency, power, pulse length, pulse repetition frequency, beam width, antenna scan rate and polarization. These properties determine the function and operating parameters of radar and may be used to classify and identify it. The characteristics are compared to a database, and the specific radar can be identified. ELINT systems require a large database of previously collected signals to be most effective. The database must be theatre specific.

32. **LISS Support to ELINT ESM**. Land integrated support station (LISS) provides the necessary databases for ELINT systems. The databases are built from the CF EW Database (CFEWDB). New ELINT signals are normally beyond the deployed EW system to exploit. The ELINT system provides the characteristics of the emitter to the LISS, which, in coordination with other agencies, identifies the emitter and updates the database. Therefore, new databases are required constantly to ensure ELINT systems identify signals correctly. Most radars may be associated with a particular gun or missile fire control system or a missile guidance/homing system. In these cases, analysis of the interception usually reveals the state of activation of the whole weapon system and the type of system the

radar is associated with. Fig 5-1 is illustrative of the how the LISS is situated to support Land Force EW ops.

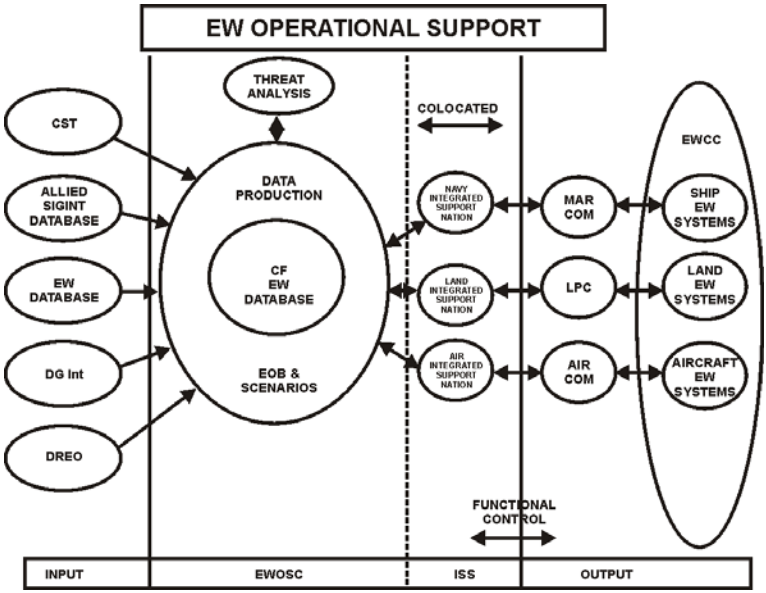

Figure 5-1: EW Operational Support

CHAPTER 6
ELECTRONIC COUNTERMEASURES

SECTION 1
GENERAL

1. Electronic countermeasures (ECM) are the offensive arm of electronic warfare (EW). Electronic countermeasures are coordinated through the targeting process as described in Chapter 3. The electronic warfare support measures (ESM) process is the target acquisition (TA) system for ECM. Electronic countermeasures are subdivided into three categories: electronic jamming, electronic deception and electronic neutralization.

SECTION 2
ELECTRONIC JAMMING

2. Electronic jamming is the deliberate radiation, re-radiation or reflection of electromagnetic (EM) energy with the object of impairing the effectiveness of electronic devices, equipment or systems being used by an adversary. Jamming used at the right time on the right targets (e.g., on command links during an assault) can greatly reduce the adversary's effectiveness by denying him critical information and communications. If jamming is poorly coordinated, it will alert the adversary and can compromise our own capability and intentions. If jamming is conducted too early, it will allow the adversary time to react and restore communications and therefore have limited effect. A jamming signal can affect both friend and foe, and its effects can be widespread. Adversary transmissions are often a source of intelligence, and if they are jammed, the information they provide is lost. Jamming, therefore, is an activity that must be closely directed and coordinated by the G3 staff.

3. Within the Land Force, EW units conduct electronic jamming. The responsibility for jamming rests with the G3/COS, and jamming is coordinated by the FSCC and electronic warfare coordination cell (EWCC). The EWCC is responsible for the execution of jamming based on targets determined by the targeting process. Coordination with other staffs, in particular the G2 and G6, is critical.

CONTROL OF JAMMING

4. Jamming operations are most successful when they are permitted the greatest possible latitude to attack both planned and opportunity targets. Coordination of jamming operations should commence early in the planning cycle and continue through all operational phases. The measures for controlling jamming are normally contained in the operations order. Control is exercised in one of four ways:

a. **Positive Control**. Positive control is the issuance of specific orders to jam and/or deceive a given target or blanket authority to neutralize by jamming and/or deception a category of target (for example, an adversary fire control net or ground surveillance radars). Frequencies and times are not specified.

b. **Negative Control**. Negative control is the denial of permission to conduct jamming (for example, no jamming before H-hour).

c. **On/Off Control**. On/off control is the direct control of a jamming operation from moment to moment.

d. **Restricted Frequency Control**. Restricted frequency lists (RFLs) are a mechanism to prevent jamming from effecting friendly operations. Annex A to this chapter provides a process and procedures for developing and maintaining RFLs. There are three categories of frequencies:

(1) **Taboo**. A “friendly” frequency on which jamming or other intentional interference is prohibited.[37]

(2) **Guarded**. An adversary frequency used as a source of information.[38]

(3) **Protected**. A “friendly” frequency on which interference must be minimized.[39]

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[37] ATP 51(A) Chapter 4.

[38] ATP 51(A) Chapter 4.

5. These four methods of controlling jamming are applied in a manner that permits maximum flexibility and minimum delay in obtaining authority to conduct jamming operations without compromising limitations imposed by superior headquarters. Unless forbidden by a higher commander or established rules of engagement, any formation commander can authorize jamming. Commanders at all levels must be fully conversant with the orders governing the use of jamming and be aware of the possible adverse effects on intelligence collection, command and control and weapon systems.

6. Jamming is a technique that is used to "capture" an adversary's communication device (radio) by radiating enough energy that the intended receiver only receives the jamming signal and only the intended one. Jamming effectiveness is determined by several factors:

a. **Jammer Power**. In general, the higher the power the more effective the jamming.

b. **Range to the target Receiver**. The closer the target, the more effective the jamming.

c. **The Link Distance**. The link distance is the distance between the transmitter and receiver. The longer this distance, the more effective the jamming is (less jamming power is required).

d. **Ground**. For ground-based jammers, the ground itself can mask the target or necessitate greater power to produce effective jamming.

e. **Power of the Adversary Transmitter**. Depending on the power output of the adversary transmitter, more jammer power may be required to effect jamming. Normally, the power output is known and can be factored into the equation to determine the required jammer power output.

7. Jammers can use a variety of modulations. It is important to tailor the jamming modulation to the target. The most successful jammer is one that is perceived as anything but a jammer. For example, the jammer can use a random Morse signal against a net

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[39] ATP 51(A) Chapter 4.

operating on Morse code or use a random data signal against a data net.

8. **Types of Jamming**. The types of jamming that may be employed are as follows:

a. **Spot Jamming**. Spot jamming occurs when a jammer attacks one frequency or narrow band of frequencies in specific use by the victim. It is normally tuneable over a range of frequencies. Spot jamming causes minimum interference with friendly systems and permits maximum use of available jamming power. A spot jammer requires very accurate knowledge of adversary frequencies.

b. **Barrage Jamming**. Barrage jamming occurs when a jammer attacks over a wide band of frequencies simultaneously. The power available will be spread over the entire bandwidth; this results in less power on any particular frequency than occurs with spot jamming. Barrage jamming is likely to harass the victim over a number of frequency options rather than totally deprive the victim of using any particular frequency. Less detailed steerage is necessary for barrage jamming. Also, the chance of interference with friendly nets is greater than with spot jamming.

c. **Sweep Jamming**. Sweep jamming attempts to compromise between the advantages of spot jamming and barrage jamming. The frequency of the jamming signal is continuously varied within a specific bandwidth. All available power is used for one frequency or a narrow band at any instant, but the tuning is swept back and forth across a whole band of frequencies. Higher sweep rates can achieve more effective results.

d. **Automatic Search Jamming**. More sophisticated jammers use advanced technology to maximize their effectiveness yet reduces their vulnerability. The automatic search jammer (also known as a responsive jammer) incorporates an intercept receiver, which automatically searches a selected band of frequencies to find frequencies of interest

for which the system has been programmed. The jamming transmitter is then automatically tuned and activated on the target frequency. For the victim station, the jamming appears to be continuous. Sometimes a capability is incorporated into the system to look through the jamming transmissions and follow any changes in frequency made by the victim. Complex systems will include a computer management function, which allocates power resources to simultaneous targets.

JAMMER PLATFORMS

9. To be effective, a ground-based jammer has to be sited close to the FLOT (forward line of own troops) so it can take advantage of the high power output (which is typically between 1 kW and 2 kW). This siting allows the jammer to be effective against targets that are in depth (for example, artillery nets), but it makes the jammer vulnerable. Thus the jammer should be mounted in an armoured vehicle. Mounting the jammer on an elevated platform such as an UAV can eliminate the loss of power of a jamming signal caused by intervening terrain (attenuation). This technique provides a line of sight path from the jammer to the target receiver, thus enabling a lower power jammer to be used. An airborne jammer of as little as 200 watts output at a distance of 40 km can be as effective as a ground-based jammer of 2 kW output at 15 km.

EXPENDABLE JAMMERS

10. Expendable jamming involves placing a low power jammer within a few hundred metres of a target receiver. This can have the same disruptive effect as a high power jammer 15 to 20 km away. Expendable jammers can be hand-placed, airdropped or artillery delivered. They can be programmed to lock on to strong local signals, or they can be programmed to switch on to a certain frequency at a predetermined time. If expendable jammers are delivered as a mix with explosive ordnance, they could seriously degrade the adversary's efforts to restore order out of chaos. Special forces, reconnaissance and forward troops may be tasked to place expendable jammers. Their use would be coordinated, as with other jamming, through the targeting process.

ELECTRONIC COUNTERMEASURES AS ELECTRONIC PROTECTIVE MEASURES: JAMMING IN NON-ELECTRONIC WARFARE UNITS

11. Systems are now available that can provide protection for Land Forces by using jammers against electronic artillery fuses such as variable-time or proximity fuses. The jammer causes the artillery round to detonate prematurely. The system detects the signal from the artillery round and automatically sends a signal, which detonates the round. The system is, in fact, a combination of ESM and ECM that provides electronic protective measures (EPM).

SECTION 3
ELECTRONIC DECEPTION

"All warfare is based on deception."
-Sun Tzu, *The Art of War*, c. 500 BC, tr. Griffith.

12. Electronic deception (ED) is the deliberate radiation, re-radiation, alteration, absorption or reflection of EM energy in a manner intended to confuse, distract or seduce an adversary or his electronic systems. Electronic deception is a component of the commander's overall deception plan,[40] which, in turn, is part of the commander's overall information operation plan.

13. The aim of deception is to mislead the adversary commander and induce him into doing something counter to his interests. The EM spectrum is an ideal medium to employ deceptive techniques because it is shared with the adversary. His ESM system is a means to provide him false information. Electronic deception is employed as part of an overall tactical deception plan and cannot be practiced indiscriminately. Careful scripting and control at the highest possible level are required as well as highly skilled operators who must be well briefed. On the other hand, low-level imitative deception can be attempted by EW elements if the aim is limited to delaying adversary traffic from a few minutes to a few hours or if there is an opportunity to temporarily confuse adversary commanders at formation or unit level. Electronic deception is a potent weapon with few of the disadvantages of jamming, but it can be very expensive in manpower and equipment.

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[40] More information on deception can be found in B-GL-352-001/FP 000 *Land Force Deception.*

14. Electronic deception must be considered during the planning phase of any deception plan. The G3 has responsibility for developing the overall deception plan. The planning of ED is the responsibility of the EWCC on behalf of the G3 (via a designated G3 IO). Many other staffs are involved with the development of deception plans. Annex B to this chapter provides a guide for the EWCC to plan and coordinate ED. Electronic deception is particularly effective in the following circumstances:

a. When the adversary relies heavily on a communications and information systems (CIS) using the EM spectrum. Electronic deception may cause the adversary—by the manipulation, distortion or falsification of electronic transmissions—to react in a manner prejudicial to his interests.

b. When the adversary ISTAR system is dependent on the ESM (tactical and national level).

c. When it is skilfully conducted and fully integrated into the overall deception plan.

d. At a critical time in the adversary's operations.

15. Electronic deception is divided into three categories:

a. **Manipulative Electronic Deception**. This type of ED puts out false information over our own emitters so it can be intercepted by the adversary and treated as real information (for example, dummy radio traffic).

b. **Simulative Electronic Deception**. This type of ED is the creation of electronic signatures (for example, false radio net).

c. **Imitative Electronic Deception**. This type of ED emits signals designed to convince the adversary these signals belong to the adversary (for example, intruding on an adversary net).

16. All units in a formation could be involved in ED. Electronic warfare units can provide imitative ED but little more.

SECTION 4
ELECTRONIC NEUTRALIZATION

17. Electronic neutralization (EN) is the deliberate use of EM energy to either temporarily or permanently damage adversary devices that rely exclusively on the EM spectrum. Electronic neutralization is usually brought about as a result of a directed energy (DE) or particle beam (PB) weapon depositing sufficient EM energy on a target so as to render useless the target, its electronics or both. The use of lasers to destroy sensitive optical viewing devices is one such example. Electronic neutralization is characterized by the requirement for line of sight (LOS) and the near instantaneous time of flight (approaching or at the speed of light).

18. Electronic neutralization carries with it a risk to our own troops. As a consequence, great care and safety must be used when employing certain types of DE weapons. Directed energy weapons will have applications in close combat, LOS engagements. The doctrine for employing these weapons will be contained in the manuals of those arms that employ the weapons. EW units are not involved directly with EN. Land EW operational support (LEWOS) may be involved in the reprogramming of systems to detect the use of EN.

ANNEX A
RESTRICTED FREQUENCY LISTS

INTRODUCTION

1. The purpose of this annex is to outline procedures for producing and maintaining restricted frequency lists (RFLs). An RFL is defined as a list of taboo, guarded and protected frequency lists. The terms taboo, guarded and protected are defined as follows:

a. **TABOO**. A "friendly" frequency on which jamming or other intentional interference is prohibited.

b. **GUARDED**. An enemy frequency used as a source of information.

c. **PROTECTED**. A "friendly" frequency on which interference must be minimized.

2. The G3 staff is responsible for the compilation, maintenance and distribution of the RFL, however, the EWCC will provide the staff effort to assist.

3. This annex is organized as follows:

a. RFL production and dissemination;

b. RFL maintenance procedures; and

c. RFL format.

SECTION 2
RFL PRODUCTION AND DISSEMINATION

4. The formation structure and associated CIS must be known in order to produce a standard RFL. The procedure for the production of the RFL is as follows:

a. Produce standard formation taboo and protected list;

b. produce guarded list;

c. G6 staff input frequencies to taboo and protected list;

d. G3 (EWCC) compile list; and

e. G3 issues RFL.

STANDARD FORMATION TABOO AND PROTECTED LIST

5. The purpose of this list is to produce a standard (SOP) list of activities (for example, AD, surveillance nets, etc) that are to be given the status of taboo and protected. These lists will facilitate the quick production of the RFL, which could readily change. Each formation, from brigade to corps, must undertake this process.

6. To produce the taboo and protected lists, the following agencies will need input:

a. G6 staff;

b. EWCC;

c. G2 staff;

d. G4 staff;

e. Arty, Avn, Engr staffs; and

f. subordinate formations.

7. G3 staff would then approve the taboo and protected lists. Once this process has been completed, the G6 staff can routinely add frequencies to the approved lists. G2 staff, with input from EWCC, produces the guarded frequency list. The G3 staff, with assistance from the EWCC and with the superior formation's RFL, produces the RFL. G3 then approves the list and disseminates to subordinate formations and EW units. Figure A-1 depicts this process.

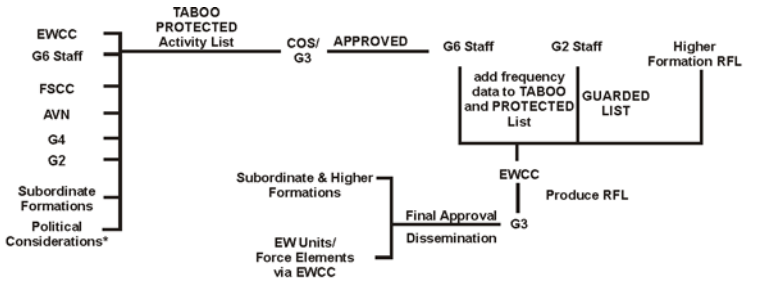

Figure 6A-1: The RFL Process

RFL MAINTENANCE PROCEDURES

8. Maintenance of the RFL is critical. The RFL shall be updated at the following times:

a. When a new operation order is being prepared. This will require a complete review of taboo and protected lists.

b. Routinely updated every 24 hours (or as necessary to conform to CEOI changes).

c. Attachments and detachments from the formation.

d. Periodic updating as minor changes occur (for example, single taboo frequency change or updates to guarded frequencies).

9. Subordinate formations, the G6 staff and the G2 staff are responsible to advise the G3 staff when changes to the RFL are required. The EWCC will ensure that EW units are immediately advised of any change to the RFL.

RFL FORMAT

10. The format and an example of an RFL are contained in Appendix 1.

APPENDIX 1 TO ANNEX A
RFL FORMAT AND EXAMPLE

*****SECURITY CLASSIFICATION*****

RESTRICTED FREQUENCY LIST—FORMATION

EFFECTIVE DATE AND TIME

TABOO	FREQUENCY	USE	TIME
1			
2			

GUARDED	FREQUENCY	USE	TIME
1			
2			

PROTECTED	FREQUENCY	USE	TIME
1			
2			

*****SECURITY CLASSIFICATION*****

NOTES

TIME—Normally the RFL will have an effective date and time. In some cases a particular frequency may have an abbreviated time period and this will be noted in column 4.

EXAMPLE RFL

*****SECURITY CLASSIFICATION*****

RESTRICTED FREQUENCY LIST—1 DIV

EFFECTIVE 120001Z TO 120001Z DEC 95

11. TABOO

a.	1	47.50 MHz—Div Comd
b.	2	71.05—Div Arty Command
c.	3	30.50—1 Bde Comd—1300–1500hrs

12. GUARDED

a.	1	2030 KHz
b.	2	53.45 MHz
c.	3	223.5 MHz

13. PROTECTED

a.	1	30.50 MHz—1 Bde Comd
b.	2	3550 KHz—Div Comd Guard
c.	3	345.5 MHz—Div Radio Relay

*****SECURITY CLASSIFICATION*****

ANNEX B
ELECTRONIC DECEPTION

INTRODUCTION

1. The purpose of this annex is to provide guidance for planning and coordinating electronic deception (ED). Electronic deception is "the deliberate radiation, re-radiation, alteration, absorption or reflection of electromagnetic energy in a manner intended to confuse, distract or seduce an enemy or his electronic systems." Electronic deception is but one component of an overall deception plan that will be an integral part of the information operations (IO) plan.

2. Electronic deception is normally conducted as a part of a commander's deception plan and must be full planned and coordinated with it. The G3 staff has general responsibilities for planning and coordination of the commander's deception plan. The EWCC is responsible through the G3 for the planning and coordination of the ED plan in support of the overall deception plan.

3. This annex concentrates on the EWCC activities necessary to plan and coordinate ED. A checklist is provided at Appendix 1 to assist EWCC staffs in planning ED. The organization of this annex is as follows:

a. ED planning; and

b. EWCC checklist for ED.

ED PLANNING

4. The deception plan has its beginning in the commander's concept of operations in which he identifies the need for a coordinated deception plan in order to successfully conduct his operation. The G3 staff, specifically a designated G3 IO, must then plan the deception in conjunction with all staff branches. The EWCC, G2 and G6 staffs will provide the advice necessary in conducting an ED as part of the overall deception plan. In some cases, the commander's entire deception plan may be based on an electronic deception depending on the enemy's intelligence gathering capabilities.

5. From an EW point of view, two aspects are critical to successful conduct of ED:

a. **Comprehensive Database**. A comprehensive database is essential to the development of ED plan in order to determine what aspects of an adversary can be deceived. The database will provide the necessary information on which adversary systems are dependent on the electromagnetic spectrum and therefore can be deceived.

b. **ESM**. Electronic warfare support measures (ESM) are critical in monitoring the success of any deception plan. ESM will likely be the first indicator of the success or failure of the overall deception plan and will provide what the adversary's reaction to our deception is. Electronic warfare support measures provide critical input into the overall database and will directly influence the ED plan.

6. The electronic deception plan will need to create a misleading picture to the enemy tactical ESM and national signal intelligence systems to the point that their reports to the appropriate commander cause him to react (or not react) in a way favourable to our commander's aim. As a result, a realistic emitter picture must be "painted." This will require significant planning and coordination to execute and will likely require emitters from various elements not just signal and EW elements.

7. The commander must set out the aim of the deception plan. The G3 IO staff then work on options for the deception plan. The EWCC will be required to do an estimate to produce options for an electronic deception plan to support the commander's deception plan. The result of this estimate will be an annex (or possibly a separate operation order) to the deception plan operation order.

8. In order to conduct the estimate, the EWCC will need to coordinate with the following:

a. G3 IO;

b. G2 Staff;

c. G6 staff;

d. higher and lower EWCCs; and

e. other arms (provision of resources).

9. It is likely that the most significant factor will be the availability of resources (emitters) to conduct the plan. The significant use of equipment could jeopardize the CIS and surveillance plans. Every effort must be made to keep the resources to the minimum necessary to successfully conduct the electronic deception.

10. The result of the estimate will produce a plan and the critical contents of the ED annex to the deception plan. The annex will contain the tasks and coordination necessary to conduct the ED. Appendix 1 contains a checklist guide to contents of the ED annex.

11. The ED annex will provide the detailed coordination necessary to execute the plan. After the issue of appropriate orders, the EWCC will need to monitor and coordinate changes necessary. Electronic warfare support measures assets will need to be tasked to monitor the enemy's reaction to the deception to confirm the success of the deception. EWCC is responsible to advise the G3 IO of the results.

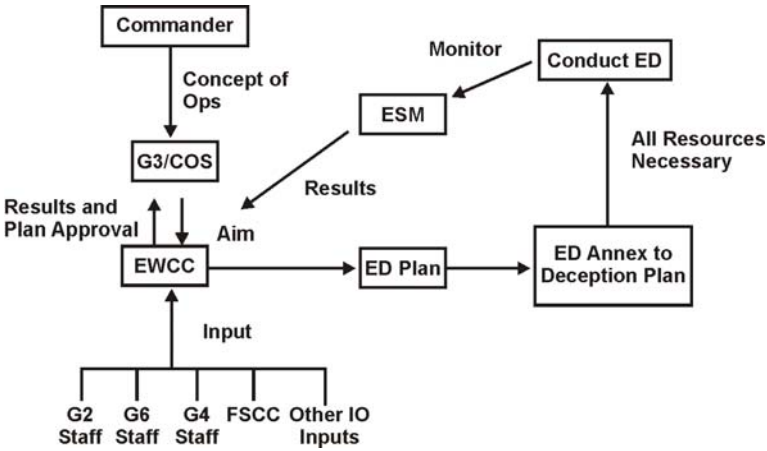

Figure 6B-1: The ED Process

APPENDIX 1 TO ANNEX B
ED PLANNING CHECKLIST

G3/G3 IO	
	Commanders IO/deception concept of ops
	Timings
	Resources available
	Additional resources from higher
G2	
	Adversary surveillance capability
	Confirming results
	ESM (tactical, coalition, strategic) capabilities required to monitor deception
	Comprehensive database
G6	
	Resources available
	Special CEOI required
	Nets required
	Spectral use
G4/Other Arms	
	Resources available
	Nets for simulation
EW	
	ESM tasks
	Monitor deception
	Database input/updates
ECM TASKS	
Subordinate Formations	
	Execute tasks
	Provide resources

CHAPTER 7
ELECTRONIC PROTECTIVE MEASURES

SECTION 1
GENERAL

1. An often neglected, but most important division of electronic warfare (EW), is electronic protective measures (EPM). These are the defensive EW measures that all units must practice and use. Electronic protective measures are an all-arms responsibility. Electronic protective measures features included in the design of command and control information system (C2IS) equipment and weapon systems must be combined with EPM procedures and tactics to reduce the effect of the adversary's electronic warfare support measures (ESM) and electronic countermeasures (ECM) effort. Commanders are responsible for assessing the potential vulnerabilities of their electronic equipment, uncovering weaknesses that may be exploited by hostile EW activities, and developing appropriate defensive EW procedures. Electronic protective measures tactics must be considered in light of the tactical situation and must be included in commander's operations plans to preclude reacting hastily during the heat of battle.

2. To develop a sound EPM, commanders and staff at all levels must:

   a. Acknowledge the extent of our own military reliance upon electronic systems and the vulnerability of those systems to ESM and ECM.

   b. Understand that the adversary has the capability to exploit and disrupt all our electronic systems. This capability, if exploited to its full extent, will give the adversary a significant tactical advantage.

   c. Take steps to ensure the adversary does not gain such a military advantage by protecting our electronic systems through well-practiced EPM procedures and tactics.

3. The aim of EPM is to defeat the adversary's ESM and national signal intelligence systems and his ECM. It is important to remember that defence against EW attack applies both in peacetime and in war. It must be assumed that the potential adversary is always listening and intercepting even though the he may reserve jamming and deception for war. The ability to survive an electronic attack

depends on our knowledge of the adversary's capability and our standard of EW training. Electronic protective measures take the form of a two-phased defence: defeat ESM and defeat ECM.

4. Some measures are both anti-ESM and anti-ECM in their effect. It is significant that ECM relies heavily upon effective ESM steerage. Therefore, most of the EPM which effectively deny the adversary an opportunity to conduct ESM prevent or reduce his ECM at the same time. Therefore, the first phase of EPM is anti-ESM.

SECTION 2
SUB-DIVISIONS OF ELECTRONIC PROTECTIVE MEASURES

5. Electronic protective measures can be technical, procedural or tactical as illustrated in Figure 7-1. The consolidated result of effective EPM is a good signals security (SIGSEC) posture, which is an important part in our overall operational security. To achieve an acceptable level of SIGSEC, the most important ingredient is realistic operator training that will enable the operator to continue to function in a hostile EW environment.

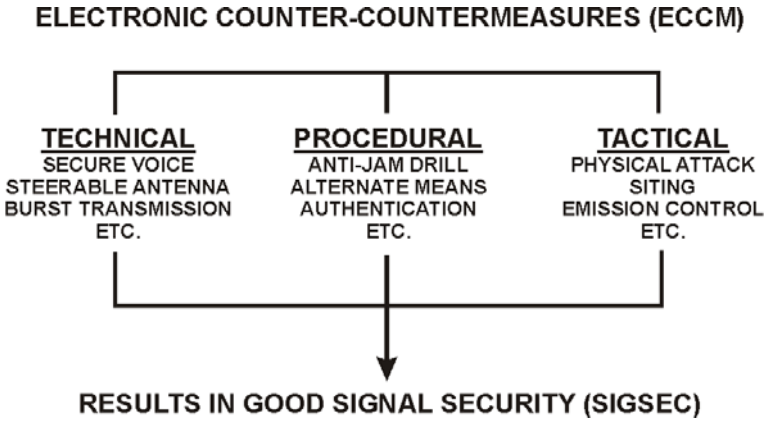

Figure 7-1: Electronic Counter-Countermeasures

SECTION 3
TECHNICAL MEASURES

6. **Design**. Electronic protective measures are becoming increasingly important in the technical design of all radio and radar equipment. New transmission, encryption and antenna techniques are

being developed to reduce electronic visibility, deny the adversary information or enable the operator to work through an electronic attack. Even the current generation of electronic equipment has some built-in EPM features. Most combat radios have variable power that can be kept low to avoid detection or can be increased to work through jamming. The gain control, which adjusts brilliance and contrast on a radar screen, may sufficiently remove the effects of chaff to reveal the wanted target.

7. **Frequency Diversity**. The development of our entire family of tactical radios also reflects a form of EPM by providing diversity across all frequency bands. For example, HF (AM) is usually used for guard communications to back up VHF (FM) radio. Similarly, UHF radio and radio relay, with their better line of sight characteristics, are used for other command and control links.

8. **On-Line Encryption**. This method will deny the adversary knowledge of the content of message traffic; however, the presence of a signal can still be detected, enabling the adversary to conduct direction finding. On-line encryption devices are used on most tactical radio circuits including voice, teletype, data and facsimile. The advanced generations of equipment enable the net control station to electronically key or exclude stations (if required).

9. **Off-Line Encryption**. This method, including machine and non-machine ciphers, can give protection to message content equal to that of on-line encryption. A variety of other lower level codes and devices can give limited protection to all or selected parts of messages. Technology has reached the point where traditional paper codes will be replaced or supplemented by a hand held calculator-type device, which can provide immediate encryption and decryption.

10. **Directional Antennae**. A more specialized method of achieving minimum power in the adversary's direction is by using directional antennae (see Figure 7-2 (a)). These are usually used for VHF and UHF radio relay systems, but can also be used for point-to-point HF and VHF radio links. Directional antennae can be used on long rebroadcast nets whereby the rebroadcast station splits and works to the forward units on low power and works rearward using a directional antenna on high power. Ideally, circuits using directional antennae should be oriented parallel to the forward edge of the battle area (FEBA) to reduce the radiation in the adversary's direction. Side and back lobes are still subject to adversary intercept but to a lesser degree.

11. **Steerable Null Antennae**. Figure 7-2 (b) shows the polar diagram of a vertical omni directional antenna or standard whip antenna. Research is being carried out on steerable null antennae (Figure 7-2 (c)), which will radiate normally in all directions. However, efficiency will be greatly reduced in the direction of the adversary antenna. As the antenna will have the same properties for both transmission and reception, radiation to or from the adversary is minimized; this will reduce the likelihood of intercept and will reduce the effect of jamming. A processor that is connected drives steerable null antennae to the radio inside the vehicle.

12. **Burst Transmission**. Digital message devices are now being developed that enable short formatted messages to be entered into a small memory then transmitted in a short burst. These devices can be used over most normal voice radios and obviously reduce transmission time for lengthy messages. Typical applications for these devices are on fire control and administrative nets and by special forces inserted into adversary territory.

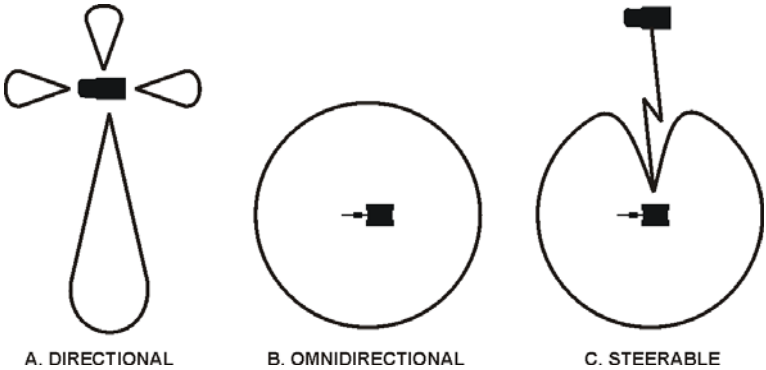

Figure 7-2: Antenna Techniques

13. **Spread Spectrum**. A new generation of frequency agile radios is being developed that automatically switch or hop the signal over a large number of frequencies instead of transmitting on a single frequency. This technique reduces the possibility of adversary intercept and jamming; however, mutual interference among numerous frequency hopping nets may also create communication problems. Another spread spectrum technique involves transmitting the signal over a wide band of frequencies simultaneously. It is similar to frequency hopping because it provides the same EPM capability; however, it also has the problem of mutual interference.

SECTION 4
NON-COMMUNICATIONS TECHNIQUES

14. **Infra-red Suppression**. As a counter to adversary infra-red (IR) seeking systems, IR signature suppression techniques can be employed. The use of water-cooling, special fuels, shielding hot engines, and reducing exhaust temperatures are all examples of vehicle and aircraft IR suppression techniques. The use of our present camouflage net, along with other IR absorbent material, greatly reduces the IR signature of any headquarters or friendly position. This is particularly important in view of the adversary's airborne IR sensor capability.

15. **Radar**. A radar concentrates great power in its transmission so reflected energy from a long-range target may be received. Due to attenuation and reflection losses, only a small fraction of the transmitted energy is returned to the radar. A sensor in the target can therefore detect the transmitted energy at ranges considerably greater than the detection range of the radar itself. This provides a significant advantage to vehicles and aircraft that are equipped with radar warning receivers. The sensors will alert the operator that the vehicle (or aircraft) is in an adversary radar path and therefore may be detected, tracked or fired upon. The operating parameters of a particular radar may also be used to identify it and possibly associate it with a unit or headquarters. Numerous signal-processing techniques are now being incorporated in modern radar equipment that vary these parameters and thus mask the identity of the equipment. Still other signal processing techniques are being developed that will enable a radar to counter adversary jamming or deception.

16. **Laser**. Similarly, as an increasing number of electronic systems on the battlefield are using laser technology, laser warning and countermeasure techniques are also being developed. For example, reconnaissance vehicles and helicopters already possess laser and radar warning receivers to detect when they are being targeted. These suites fundamentally follow the ESM process as an EPM, leading to information being provided very quickly to a crew commander who must take action. Some of these suites will require database support from a LISS. As new equipment is procured more and more vehicles will be fitted with these suites.

17. **Electromagnetic Pulse**. Commanders must develop plans for the best use of their critical communication and electronic equipment which satisfy operational requirements but also recognize that essential electronic equipment can be severely damaged by

electromagnetic pulse (EMP). Hardened equipment should be placed in support of the most critical task. Unhardened equipment should be used in less sensitive and routine applications to preserve the readiness of hardened equipment as much as possible.

SECTION 5
PROCEDURAL MEASURES

18. The primary defence against EW attack is to avoid detection. In many instances, this will not be possible, but the electronic battlefield will be very crowded, and the weaker a signal, the more difficult it will be to intercept and locate. It then becomes essential to conceal the level and identity of the net or type of equipment and to encode sensitive message content. The adversary must be forced to commit disproportionate resources for any intelligence gained from our electronic systems.

19. Jamming and deception require strict control and will be applied only after careful planning. If the function and identity of a net or type of equipment can be concealed, the adversary may not consider it to be worth exploiting. Before jamming and deception can take place, the adversary must go through the process of search, intercept and direction finding. If the net is thought to be important or if a critical stage of the battle has been reached, jamming or deception will be considered as an attack option. The adversary has to decide whether it is going to gain more from intercept or from disruption.

20. The procedures used to operate all our electronic equipment must be well practised by all users. These procedures are aimed at denying the adversary EW effort any advantage. Procedural EPM can be summarized as follows:

a. avoid detection;

b. avoid identification of equipment/net;

c. maintain security;

d. defend against deception;

e. defend against jamming; and

f. report any ECM activity.

21. The principal aim of every operator must be to avoid detection. If the adversary is unable to detect our electronic emissions, he cannot follow up with any form of attack. It is difficult to remain

concealed all the time, but the longer it takes the adversary to detect our communications and radars, the longer the communications and radars will survive. The following procedures, which every operator and user can practise, will greatly reduce the chance of being electronically detected on the battlefield:

a. minimize power output;

b. use terrain to provide screening;

c. reduce antenna efficiency;

d. minimize emitter use;

e. keep transmissions short; and

f. use alternate means of communications.

22. **Minimum Power**. Siting, distance and power output will affect the electronic visibility of a target transmitter to an adversary intercept operator. The first two factors are tactical considerations and are discussed further in Section 6 of this chapter. However, minimum use of power is a procedure that should be second nature to all operators. It is important not to use more power than is necessary to provide communications. Reduction in power, and therefore electronic visibility to the adversary, is achieved by switching to low power or reducing antenna efficiency. For example, most emitters have two power levels; used wisely, the chances of being intercepted are greatly reduced.

23. **Reducing Antenna Efficiency**. On certain sets there may be no power setting options. Using a less efficient antenna can reduce radiated power. It is not necessary to use an elevated ground-plane antenna if a vehicle-mounted whip will suffice. Also, an antenna must be sited with the adversary in mind and, where possible, a directional antenna used (see Section 3 Tactical Measures).

24. **Minimum Use of Electronic Emitters**. The adversary can detect any transmission in any frequency band. Speech security devices will protect only the message content. In all other respects, secure systems are as vulnerable as insecure systems; they also highlight the more important nets. Use short transmissions on minimum power, and transmit only when necessary. Although short transmissions will not stop intercept and direction-finding activity, they will make the adversary operators' task more difficult. The use of formatted messages and brevity codes will also reduce the transmission time for longer messages. A common fault is the lack of

confidence that some operators and users have in their radio equipment, which leads to unnecessary radio checks.

25. **Alternate Means**. Various means of communications are provided to reduce our reliance on electronic systems. This not only reduces the number of transmissions (a preventive measure) but also provides a back up at the onset of jamming. When the situation allows, formation, unit, and detachment commanders must always consider passing messages by alternate means such as:

a. line;

b. runners;

c. civilian or commercial telephone;

d. liaison officers;

e. dispatch riders; and

f. visual signals.

26. These alternate means are vulnerable to intercept or capture, so sensitive messages must still be encoded. The civilian telephone system is particularly vulnerable, so standard procedures and codes should always be used.

27. **Avoiding Detection**. Despite our efforts to reduce the electronic visibility of our transmitters, it must be assumed that the adversary will still be able to intercept and locate some of our communication and electronic equipment. The next level of defence then relies on commonality. The adversary must identify important nets/equipment to select targets for further electronic or physical attack. Measures that can be used to avoid identification are:

a. employment of standard radio procedures;

b. utilization of authorized codes only;

c. adherence to communications-electronics operating instructions (CEOI);

d. implementation of frequency changes (when operating in single channel non hop mode); and

e. changing electronic signature.

28. **Standard Procedures**. Strict adherence to basic voice and telegraph procedures is the foundation of good EPM. Any departure from these procedures allows adversary intercept to label the operator

and operator idiosyncrasies and to use them to identify units. Procedures are a mixture of common sense and easily understood phrases and abbreviations, which help to hide the level of a net, disguise the identity of the unit and speed up radio conversations. Standard procedures apply to both secure and clear nets: reduce transmission time and avoid breaches of security as an operator/user goes from a secure net to a clear net. The responsibility rests with control stations to maintain good net discipline.

29. **Authorized Codes**. Authorized codes only must be used. Unauthorized local unit codes (for example, reference points) will enable the adversary to identify the unit using them. Any trained crypto-analyst can break unauthorized local unit codes easily.

30. **Communications-Electronics Operating Instructions**. The material included in CEOI is not only designed to maintain order in our entire communication system but also to confuse adversary ESM by periodically changing station/net identifiers. Communications-electronics operating instructions material includes:

a. station call signs;

b. net identification signs;

c. address groups; and

d. frequency allocation.

31. **Frequency Changes**. When the frequency assignment allows, change frequency at irregular intervals. This will make the adversary search and intercept operator's task more difficult and will destroy the continuity of their intelligence gathering effort. If it is possible, change operators and call sign indicators at the same time you change frequency. This tactic is very effective. Try to reserve at least one frequency so the net can evade effective jamming.

32. **Changing Electronic Signature**. During frequency changes, using different antennae and changing radios will make identification based on electronic signature more difficult.

33. **Breaches of Security**. The adversary will always seize any breaches of security; they offer the adversary real-time intelligence which can be acted upon almost immediately. If a breach of security occurs, it must be reported. Commanders will then be able to assess the seriousness of the breach and take steps to counter any resulting adversary action. Codes must be used to conceal the sensitive content of a message if the net is operating in clear. It is vital that:

a. formations and units are never referred to in clear;

b. locations of our troops are never revealed;

c. no mention is made of personalities;

d. place names are always encoded; and

e. grid references, including adversary locations, are always encoded.

34. **Bad Habits**. Most operator errors that assist adversary analysts are obvious, but bad habits also provide a means of identifying a specific individual, unit or net. Individual operator/user idiosyncrasies provide unique signatures that can easily be tracked across the frequency spectrum and can be used to locate an individual and identify a unit or net on the battlefield.

35. **Defeat Deception**. Once the adversary has identified an important net and decided that it no longer has intelligence value, the adversary may attack the net using imitative deception (intrusion into a net). Friendly EW units must also be aware of adversary attempts at simulative and manipulative deception aimed at misleading EW analysts. Deception will usually occur at a critical stage in the battle, when the adversary feels he has the best opportunity to disrupt or confuse our command and control.

36. **Intrusion**. The adversary's ability to intrude by imitative deception will be greatly reduced if correct procedures are used and if operators remain alert on well-disciplined nets. The reaction to suspect intrusion is simple—**authenticate**. If the challenged station cannot authenticate or takes a suspiciously long time to authenticate, deception can be confirmed. Once the intruder has been identified, control must warn all stations on the net, which must then ignore the intruder. If the intruder persists and is causing an unacceptable amount of disruption, the net should change frequency. It is important not to let the adversary know what degree of success he is achieving; therefore, codewords should be used to warn the net or to order the frequency change.

37. **Defeat Jamming**. As operators or users of electronic equipment, the first indication that a radio net or radar is under attack by jamming could be an increase in interference. At first this may have little effect, but as the jammer power is increased, it will become progressively more difficult to communicate or to operate the radar. Subtle disruption of the net may continue for a considerable period

before jamming is even recognized. Recognition of jamming depends largely on an operator's experience and training.

38. **Anti-Jamming Drill**. Reaction to jamming should follow a logical sequence. As soon as jamming interference on a net is suspected, the operator must react to it and report it. The operator checks are:

a. First, remove the antenna or coaxial cable from the set. If the interference disappears, the set is working and the operator can assume that the adversary is jamming. If the interference does not disappear, the operator can suspect a fault or local interference, for example, from a generator.

b. Once jamming is established, check the tuning of the set and try to work through it.

c. If jamming persists, re-site the antenna or move to put a screen between the set and the jammer.

d. Relay through another station if possible.

e. Temporarily increase power.

f. As a last resort, change frequency in accordance with SOPs. If possible, one or two stations should remain on the jammed frequency to simulate an unaffected net. Remember that the jammer is likely to have a look-through capability and it is vital that the adversary thinks his jamming is not successful.

g. If the operator is working voice on an HF net, the operator can change to Morse Code (CW) or reduce transmission speed. Although radar jamming is more difficult to defend against, most of these anti-jamming drills may still apply to radar operators. Similar drills should be established for each type of electronic equipment.

39. **Operator Training**. Jamming can be beaten. Success depends on the skill and experience of the operators concerned. Clear, simple instructions on anti-jamming drills and loss of communication procedures will help, but most important is the training of all operators and users against real jamming. This implies that some degree of jamming must be incorporated in all field exercises.

40. **Reporting**. Every station which suspects intrusion or jamming must report it. Intrusion and jamming can be selective, and other stations on the net may not be aware of the adversary activity. The intrusion or jamming will be verified by signals to confirm whether it is adversary ECM or just mutual interference with another friendly net. If it is the latter, new frequencies may then be assigned. If it is, in fact, adversary deception or jamming, EW elements can be tasked to locate the adversary ECM station. With sufficient target accuracy, G3 may decide to physically attack an adversary jammer. In addition, meaconing is reported to warn the air and aviation staff of adversary meaconing activity.

41. At unit level, a report must be submitted to the detachment commander or the signal officer. At formation level, jamming and deception is reported to the duty signal officer, who can initiate affected frequency monitoring and provide frequency reassignment. The EW staff at formation level also receives these reports so it can start ESM to identify and locate the source of the interference (see Chapter 5, Section 3 for more details). The report should be passed on secure means and as fast as possible.

42. **Meaconing, Intrusion, Jamming and Interference Report**. The complete report format for all possible adversary meaconing, intrusion, jamming and interference (MIJI) is included as Annex A and will be used for all reporting at formation level. The MIJI report format is an extract of STANAG 6004, which Canada has ratified and will use for reporting at the command/national level and when working with other NATO nations.

43. **Short Report**. At the unit level, the emphasis must be on speedy reporting rather than detail to achieve the desired results. A short deception/jamming report should include, as a minimum, the following information and should be submitted immediately upon recognizing jamming or deception

a. jamming report:

(1) the grid reference and call sign of the victim;

(2) the frequency or net affected;

(3) the type of jamming (e.g., noise, Morse Code, music); and

(4) any other information available such as:

(a) time of jamming;

(b) effectiveness of jamming; and

(c) duration of jamming (if it does not delay the report); and

b. deception/meaconing report:

(1) the grid reference and call sign of the victim;

(2) the frequency or net affected;

(3) the type of deception (e.g., voice, Morse code, previously recorded traffic); and

(4) any other information available such as:

(a) the call sign used by the intruder;

(b) the time and duration of intrusion; and

(c) the accent of the intruder.

SECTION 6
TACTICAL MEASURES

44. In addition to the technical EPM features of our electronic equipment and the procedures that operators/users must follow to defend against adversary EW, there are also several tactical measures that commanders at all levels can adopt to protect our command and control information system (CCIS). These tactical measures include:

a. a well-planned emission control (EMCON) policy;

b. wise siting of headquarters, communication facilities and radars;

c. good communication planning; and

d. offensive action as a form of EPM.

45. **Emission Control**. Emission control comprises all measures intended to ensure friendly electromagnetic emissions do not yield valuable information to the adversary. When EMCON is applied to operational planning, there are two terms used to restrict the use of electronic systems:

a. **Electronic Silence**. This applies to all transmitters, including radio, radio relay, radar, beacons, active IR, laser range finders and any other electronic system that radiates.

b. **Radio Silence**. This applies to only combat net radio and radio relay (although radio relay is sometimes exempt due to its directional features).

46. **Factors**. The imposition of electronic or radio silence is the most effective form of EW defence; however, this may not always be possible. The length of time that commanders can operate without radio communications or radar will depend on the battle situation and also on alternative means of passing and receiving information. Electronic or radio silence duration will also depend on the degree of vulnerability commanders are willing to accept due to the temporary loss of certain electronic systems such as battlefield surveillance and air defence.

47. **Control**. Emission control is controlled at the highest practical level to avoid subordinate formations issuing completely different policies, which would enable adversary ESM to rapidly determine formation boundaries. There are times when electronic or radio silence should be mandatory (for example, when units are in reserve), but care should be taken when applying these measures. The imposition of radio silence may indicate to the adversary that a move is in progress or important operations are about to commence—the very thing that radio silence was intended to conceal. In these circumstances, the aim must be to maintain normal radio activity—neither a sudden increase in traffic nor a cessation in activity that will attract the adversary's attention.

48. **Siting**. Using minimum power can reduce the electronic visibility of a transmitter to adversary intercept. Good tactical siting is another method of reducing transmitted and received power in the adversary's direction. There is no doubt that operators tend to select sites that give maximum communication efficiency but offer little electronic security. There is little use in excellent physical camouflage if your transmissions give away your location. Instead of sitting on top of a hill radiating in all directions, it would be electronically more secure to move down the hill, be screened from the adversary and still communicate. If your task demands that you occupy a vantage point overlooking the adversary, use the remote facility to site your radio on the reverse slope.

49. **Screening**. Careful siting may reduce the quality of communications, but this is more acceptable than being detected by the adversary. Terrain is not the only form of screening that can be used: woods, buildings, and vehicles will all offer some degree of protection. Every commander and radio operator should automatically take the adversary's position into consideration when they choose the location for an antenna.

50. **Headquarters Layout**. Proper tactical deployment of a headquarters will provide good camouflage and concealment in an electronic sense as well as a physical sense. When the tactical situation dictates, operators should make best use of radio remote equipment to provide improved security for the main command elements and improved siting for the communication facilities. Wise use of remotes will also assist in disrupting or dispersing the unique electronic signature of a headquarters. Even with radios working directly from command vehicles, the headquarters layout should take into consideration all siting factors that will reduce the electronic visibility. This also includes IR suppression, so buildings and IR reflective camouflage nets should be used to reduce the IR signature.

51. **Defence by Frequent Moves**. The best defences for most headquarters and communication facilities are concealment and to move as often as possible. Despite good EPM, the adversary will eventually be able to locate important command and control elements. Frequent moves will not only disrupt the adversary's direction-finding effort, but will also confuse analysts as they attempt to construct our electronic order of battle. Upon arrival in a new location, new call signs and frequencies should be used (if possible). Radio rebroadcast and relay stations are also particularity vulnerable, and back up detachments should be deployed separately to enable frequent movement yet provide continuous communications.

52. **Nap-of-the-Earth Flying**. Nap-of-the-earth (NOE) flying is also a form of tactical EPM that aircraft, particularly helicopters, use as a tactic to avoid adversary radar.

53. **Communication Planning: Net Dispersion**. With combat net radio, there is a temptation to use the increased range to disperse nets more widely. Greater dispersion of nets will usually lead to using higher power levels and will, in turn, cause greater vulnerability to jamming. Tight deployment will greatly enhance a net's ability to avoid detection and work through jamming.

54. **Communication Planning: Radio Rebroadcast**. Care must be exercised when deploying and using radio rebroadcast (RRB) stations. The very fact that RRB is being used on a particular net will identify the net as important and draw the attention of an adversary intercept operator. To function, RRB stations transmit on two or more frequencies (often from high ground), which renders them extremely vulnerable to adversary intercept, direction finding and jamming. Communication planners must be cautious when employing and siting RRB stations.

55. **Communication Planning: Radio Relay**. As for all radio systems, use care when you site radio relay terminals and repeaters. Due to the directional nature of radio relay antennae, circuits should be planned parallel to the FEBA as much as possible to avoid "shooting" straight across into adversary intercept.

56. **Communication Planning: Communication Diversity**. This is achieved by deploying different kinds of systems. For example, if the adversary has a profusion of VHF jammers, HF radio may be employed in lieu. Although satellite communication and tropo scatter systems are vulnerable to ECM, an adversary may not have the necessary sophisticated resources to attack these systems. Line, signal dispatch service and liaison officers offer highly reliable, although slower, means for passing messages. They may, on occasion, prove to be the only available means of communication.

57. **Defence by Physical Attack**. As an extreme form of EPM, adversary EW elements could be destroyed by physical means (artillery, anti-radiation missiles, rockets, bombing, fighting patrol, etc.). Although a high priority target, adversary ESM elements will likely be difficult to detect or locate. Electronic countermeasures detachments, on the other hand, offer a lucrative target when operating against our communications and should be located and destroyed as a matter of priority.

58. **Defence by Electronic Attack**. One example of employing jamming as tactical EPM is using expendable unattended jammers set to friendly frequencies and placed forward of withdrawing troops. This electronic screen would be strong enough to interfere with adversary intercept, denying them knowledge of the withdrawal, yet are far enough away not to interfere with the friendly radios. Simulative and manipulative deception employed in a similar fashion could also be considered a form of tactical EPM.

SECTION 7
SIGNALS SECURITY

59. **Definition**. Signals security (SIGSEC) is a generic term that includes both communication security (COMSEC) and electronic security (ELSEC), which are defined as follows:

a. COMSEC is the protection resulting from measures taken to deny unauthorized persons valuable information which might be derived from intercepting and studying our communications and related material; and

b. ELSEC is the protection resulting from measures taken to deny unauthorized persons valuable information, which might be derived from intercepting and studying non-communications electromagnetic radiations (e.g., radar).

60. **Responsibility**. Signals security is the result of good EPM. As a component of our overall operational security posture, SIGSEC is the responsibility of commanders at every level. Although SIGSEC officers will be appointed to implement detailed instructions and to provide advice, commanders remain ultimately responsible for the integrity of their information. Users at every level, however, also have an individual responsibility to maintain SIGSEC at the highest possible level.

61. **Divisions of SIGSEC**. The following divisions of SIGSEC are applicable to both COMSEC and ELSEC:

a. transmission security;

b. cryptographic security;

c. physical security;

d. electronic emission security (TEMPEST); and

e. personnel security.

SECTION 8
TRAINING

62. Training all operators/users is at the heart of the entire defensive EW posture. Lack of training will largely negate all the technical, procedural and tactical measures of which EPM consists. It is important that personnel concerned with the control, use or

operation of electronic equipment understand the EW threat and are thoroughly trained in all EPM measures.

ANNEX A
MEACONNING, INTRUSION, JAMMING, INTERFERENCE

WARNING (MIJIWARNREP)

704.22 - MEACONNING, INTRUSION, JAMMING, INTERFERENCE WARNING (MIJIWARNREP)

1. Purpose. Used to warn of hazardous EW sit caused by meaconing, intrusion, jamming and interference (MIJI) incidents which are of hostile, friendly (inadvertent) or unknown origin:

A		MIJI Incident type	
B		Unit designator(s) of affected unit(s) (1)	
C		System(s) affected (1)	
D	 1 2 3	Loc (1) Stage of confirmation (2) Geographic type Grid reference	
E		Frequency(ies)/channel(s) affected and other relevant details (1)	
F		Duration (Date-Time Group (DTG) followed by duration in minutes) (1)	
G		Assessment/description of incident (1)	

NOTES

1. Repeat as nec for each different unit/system/frequency/channel affected.
2. 'Stage of confirmation' from, as appropriate:

CODE	Meaning
REAL	Confirmed
PLAN	Planned
ESTD	Estimated

CHAPTER 8
OFFENSIVE, DEFENSIVE AND DELAYING OPERATIONS AND TRANSITIONAL PHASES

SECTION 1
GENERAL[41]

1. Whether employed in view one or view two operations, electronic warfare (EW) assets may be either light or heavy, dependent on the threat environment, logistics limitations and the commander's courses of action (COAs). When selecting assets to be employed, the potential for a change in posture or type of operation must be considered. Notwithstanding this, transition from light to medium, vice versa or augmentation of the initial deployment (a mix of light and medium assets) is limited only by logistical considerations. Transition can take place as a relief in place with no interruption in the support provided to the commander. In either mode and at all scales—whether single detachment or full Main Contingency Force (MCF) deployment—EW assets will be deployed with integral rear-link capability to national elements in order to provide the supported commander at whatever level with the full capability of strategic and coalition EW assets

SECTION 2
OFFENSIVE OPERATIONS

2. **General**. The principal purpose of offensive operations is to defeat the adversary, imposing our will on him by the application of focused violence against his weaknesses not only on his forward elements but also throughout his depth. Offensive operations defeat the adversary either by breaking his cohesion, by physical destruction or both. Destroying the coherence of his operations and fragmenting and isolating his combat power causes real damage to the adversary's will. By so doing, the adversary's capability to resist is destroyed. Other subsidiary purposes of offensive action are to:

a. gain information;

b. deprive the adversary of resources;

c. deceive or divert the adversary from the main effort;

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41 All operations are addressed in more detail in B-GL-300-002/FP-000 *Land Force Vol 2, Land Force Tactical Doctrine.*

d. fix the adversary to prevent him from regrouping or repositioning his forces;

e. pre-empt to gain the initiative;

f. disrupt adversary offensive action; and

g. seize ground.

3. **Types of Offensive Action**. There are a number of offensive actions, which may flow from one to another, but all either lead to, or stem from, the actual attack. Some can even do both. An attack may lead to exploitation, which may take the form of a continuation of the attack or become a pursuit. It is also possible for a pursuit to be followed by an attack. There are a number of different types of offensive actions with specific purposes:

a. **Hasty Attack**. "A hasty attack is an attack in which preparation time is traded for speed in order to exploit an opportunity" (AAP-6). It seeks to take advantage of the adversary's lack of preparedness, and involves boldness, surprise and speed in order to achieve success before the adversary has had time to improve his defence posture.

b. **Deliberate Attack**. "A deliberate attack is a type of offensive action characterized by planned and coordinated employment of firepower and manoeuvre to close with and destroy or capture the adversary" (AAP-6). When a well-prepared adversary defence must be defeated, a deliberate attack may be required. The emphasis is on preparation, at the expense of speed and time, therefore methods other than speed will be required in order to achieve surprise.

c. **Counter-attack**. The purpose of a counter-attack is to defeat an adversary who becomes vulnerable by his own offensive action, by revealing his main effort or creating an assailable flank. It is likely to be conducted as part of a defensive operation by a reserve or lightly committed forward elements, and it affords the defender the opportunity to create favourable conditions for the commitment of combat power and a switch to offensive action.

d. **Spoiling Attack**. The spoiling attack is similarly directed at adversary offensive operations but with the limited aim of disruption. It attempts to strike the adversary while he is most vulnerable or while he is on the move prior to crossing his line of departure. A spoiling attack is pre-emptive in nature as it attacks the adversary's plans and hence his cohesion. When the situation permits, however, commanders can exploit a spoiling attack like any other attack.

e. **Reconnaissance in Force.** The purpose of a reconnaissance in force is to compel the adversary to disclose the location, size, strength, disposition or intentions of his force by making him respond to offensive action.

f. **Raid**. The wider purpose of a raid is to disrupt the adversary. More specifically, a raid is carried out to destroy or capture a vital adversary asset.

g. **Feint**. The purpose of a feint is to deceive. It aims to fix the adversary by distracting him and, if necessary, engaging him in combat in order to support the development of the main effort elsewhere on the battlefield.

h. **Demonstration**. The purpose of a demonstration, in contrast to that of a feint, is to distract the adversary's attention without seeking combat. Demonstration forces use firepower, manoeuvre and command and control warfare to support a deception plan. It should also be aimed at a vital sector of the adversary's defences if he is to be successfully misled.

4. **Tasks**. EW tasks in offensive operations are related to the acquisition of information. The tasks do not differ greatly depending on the type of offensive operation conducted. Intelligence, surveillance, target acquisition and reconnaissance (ISTAR) tasks in the offence include:

a. locating the adversary’s main defensive area;

b. identifying gaps where the adversary weakness can be exploited for the break-in battle;

c. locating the adversary counter-attack forces and reserves;

d. identifying command relationships between units in the main defence in order to exploit unit boundaries;

e. identifying key command and control communications networks to assist the information operations (IO) battle;

f. locating minefields, obstacles and gaps in them;

g. identifying forces in depth (specifically artillery) and detecting movement that might threaten the attacking forces; and

h. evaluating the effectiveness of a feint or demonstration.

5. **Exploitation**. Normally the EW squadron moves forward one tactical bound behind the manoeuvre units in offensive operations. As the attack turns to exploitation, a decision must be made either to pass the EW squadron through the objective to maintain electronic contact with the adversary or to remain in location. The key decision to be made during exploitation is not “if” to move forward to maintain electronic contact but “when” to move forward.

6. **Coordination**. Many ISTAR assets, including EW assets, need to be located close to the manoeuvre troops in order to achieve their missions. As a result, there is a requirement to coordinate terrain management and road movement with the manoeuvre units to ensure that adequate space is allocated to ensure that support can be maintained throughout the attack.

SECTION 3
DEFENSIVE OPERATIONS

7. **General**. Defensive operations are normally undertaken when the adversary has the initiative to prevent him from seizing terrain or breaking through into a defended area. The aim is to break the adversary attack, destroy his forces and stop him from accomplishing his aim and, in so doing, to establish the conditions for maintaining the initiative through offensive action. A defensive operation may be required to:

a. destroy the adversary's offensive capability and cause his attack to fail;

b. fix the adversary in order to allow friendly forces to strike elsewhere;

c. gain time in order to complete the preparation for a counter-offensive; or

d. retain terrain and prevent the adversary from breaking through.

8. Although defensive operations may take a wide variety of forms, they can essentially be divided into two broad categories:

a. **Mobile Defence**. Mobile defence focuses on the destruction of the attacking force by permitting it to advance to a position that exposes it to counter-attack and envelopment. The emphasis is on defeating the adversary rather than retaining or retaking ground. Mobile defences employ a combination of offensive, defensive and delaying action necessitating the forward deployment of relatively small forces and the use of manoeuvre supported by fire and obstacles to seize the initiative from the attacker after he has entered the defended area.

b. **Area Defence**. Area defence focuses on the retention of terrain by absorbing the adversary into an interlocked series of positions from which he can largely be destroyed by fire. The emphasis here is on retention of terrain or its denial to the adversary.

9. **Stages of the Defensive Battle**. The defence is a single battle fought in two stages. These stages are:

a. covering force battle; and

b. the main defensive battle, including countermoves (reinforcing, blocking and counter-attacking).

10. **Tasks**. The tasks of the EW squadron in the defence are:

a. identify the adversary main effort and avenues of approach;

b. identify weakness in the adversary formation, thereby providing opportunities to attack the adversary's cohesion.

c. identify the location and avenues of approach of the second echelon forces;

d. support deep operations by detecting targets in accordance with the attack guidance matrix (AGM);

e. provide flank security through surveillance and liaison with flank formations; and

f. provide surveillance in the rear area.

11. **Coordination**. In the covering force stage, ISTAR assets, inclusive of EW sensors, are usually deployed in the covering force area. Terrain must be allocated in the covering force and the main defensive areas for EW sensors. Passage of lines for withdrawing of all sensors must be coordinated. Since many ISTAR sensors are dispersed across the battlefield, liaison may need to be conducted on their behalf by the electronic warfare coordination cell (EWCC) or the ISTAR coordination centre (ISTAR CC).

SECTION 4
DELAYING OPERATIONS

12. **General**. A delaying operation is “an operation in which a force under pressure trades space for time by slowing down the adversary's momentum and inflicting maximum damage without, in principle, becoming decisively engaged” (AAP-6). It is likely to be carried out in less than ideal conditions: the air situation may well be unfavourable and the initiative will tend to be with the adversary. Nevertheless, in order to enhance the chances of success, every opportunity should be taken to initiate aggressive action, to seize the initiative from the adversary and to force him to adopt a defensive posture. This type of operation is arguably the most difficult to conduct and needs, therefore, to be thoroughly understood by all involved. A delaying operation is likely to be conducted in one of the following circumstances:

a. by a covering force for defending or withdrawing main bodies;

b. by the advance guard or covering forces when encountering superior forces;

c. as an economy of force operation conducted to hold an adversary attack on a less critical avenue of approach;

d. as a deception measure to set up a counter-attack; and

e. as part of a mobile defence.

13. **Conduct**. The delay cannot be broken down into a series of distinct phases. It is a fluid battle that is characterized by certain key events.

14. **Disengagement**. Troops withdrawing from a position must attempt to break contact with the adversary. This can be achieved by withdrawing through a position occupied by another unit or suddenly breaking off the engagement when the adversary is unable to follow up immediately. Electronic warfare assets (as part of an overall ISTAR capability) can assist in the disengagement by identifying adversary forces before friendly forces are fully engaged. This will allow fire support assets to be brought to bear in order to assist the disengagement of the delaying force.

15. **Breaking Contact**. The move of the delaying force into an area where another force takes over responsibility is a critical operation, especially if the force has been unable to disengage. The overall commander will specify a handover line. The EW assets support this event through the provision of accurate information on dispositions of the adversary. This provides the commander with a better idea of when to break contact and the resources that are required to be allocated to assist in the breaking of contact.

16. **Employment of Reserves**. Reserves are important for the maintenance of the cohesion and continuity of delaying operations, particularly where the adversary has been able to outflank or to penetrate through gaps between delaying force elements. Electronic warfare provides the Red situational awareness (SA), which gives commanders the information they need to make good decisions on when and how best to employ reserves. Reserves can be given the following tasks:

a. **Blocking**. Containing the adversary in the area where insufficient forces have previously been deployed.

b. **Counter-attacks**. Normally, these will have limited objectives. It may be necessary to use reserves to counter-attack into gaps or in order to achieve disengagement of heavily committed forces.

c. **Covering Actions**. Reserves may also be used in prepared positions to cover withdrawing forces in order to enable them to continue the engagement.

17. **Control Measures**. The following control measures may be employed in delay operations:

a. boundaries and control lines such as handover lines and phase lines;

b. fire support coordination measures;

c. air space coordination measures;

d. movement control measures such as routes and check points;

e. barrier coordination measures;

f. battle positions;

g. blocking positions and assembly areas for reserves;

h. objectives;

i. timings;

j. liaison measures; and

k. denial measures.

18. **EW in the Delay**. A delaying force is usually expected to engage in combat in order to achieve its mission. As a result it is not a mission normally assigned to an EW unit. There are several ways in which EW can contribute to the delay:

a. **Brigade as a Delaying Force**. If the brigade has been assigned the mission to delay, all resources of the brigade will be committed to the conduct of the delay. The EW unit will be integral to this effort;

b. **Support to Brigade Delay**. If the brigade has tasked a manoeuvre unit to delay, the EW unit will likely be required to support the delay in its information collection capacity.

c. **EW Squadron as a Delay Force**. While very unlikely, the EW squadron could be reinforced with manoeuvre and fire support assets in order to

conduct a delay. This may be tasked as a guard force.

19. **Coordination**. Electronic warfare assets will normally withdraw in concert with the delaying force. They may be deployed to screen the movement of the delaying force as it hands responsibility over to another force. Alternately, EW assets may be supporting the delaying force but withdrawing in advance. Care must be taken not to interfere with the operations of the delaying force, but EW assets should not be sacrificed in an effort to preserve the combat power of the delaying force.

SECTION 5
TRANSITIONAL PHASES

20. **General**. The offence, defence and delay are the principal operations in war fighting. The linkage between these different operations is usually achieved by executing a transitional operation. The successful execution of a transitional phase will lead to:

a. the ability to make a transition between phases without a loss in tempo;

b. the forces taking over the battle having the most up to date information;

c. fluid movement;

d. fire control so as to use all weapons to further the aim and to avoid fratricide; and

e. quick regrouping.

21. There are five transitional phases:

a. advance to contact;

b. meeting engagement;

c. link-up;

d. withdrawal; and

e. relief.

22. **Advance to Contact**. In the advance to contact, the commander seeks to gain or re-establish contact with the adversary under the most favourable conditions for the main force. The advance to contact is always executed in preparation for a subsequent

operation, such as an attack, and is terminated when the main body is positioned in accordance with the commander's plan. Subsequent operations will be determined by the mission assigned to the main force. This may also be determined from the posture of the main body when contact is made with the adversary.

23. The principal role of the EW system in the advance is to locate and identify the adversary as quickly as possible so that transition to the offence can occur. This is mainly achieved by screening with the reconnaissance squadron. Since the adversary is in defence, he is more likely to be employing emission control (EMCON) procedures on electronic equipment and thus imagery intelligence (IMINT) is likely to be more useful. The advance would normally be conducted under conditions of air superiority and thus airborne IMINT systems can be employed.

24. **Meeting Engagement**. The meeting engagement is a combat action that may occur when both sides seek to fulfil their mission by offensive action. It will often occur during an advance to contact and can easily lead to a hasty attack. In offensive, defensive or delaying operations, it will often mark a moment of transition in that the outcome may well decide the nature of subsequent operations. This is why a meeting engagement is described as a transitional phase. Even when the main part of a force is attacking, defending or delaying, individual elements may find themselves in situations that have the characteristics of a meeting engagement. The meeting engagement differs from the advance to contact in that it occurs unexpectedly, whereas in the advance to contact, the commander is deliberately seeking to establish contact with the adversary.

25. Electronic warfare seeks to avoid the meeting engagement by achieving information superiority and thus identifying the adversary’s movement and providing enough warning to the force in order to transition quickly to the offence. Friendly forces will use their superior combat power and mobility to press the attack through precision manoeuvre at the time and place of their own choosing. The adversary will be faced with the uncertainty and confusion that normally accompanies the meeting engagement. Upon contact with the adversary, EW will monitor the adversary’s actions in order to sustain the information superiority and keep the adversary off balance.

26. **Link-Up**. Link-up is conducted to join two friendly forces in adversary-controlled territory. It may therefore be necessary to destroy the adversary between these forces before a link-up is established. Both forces may be moving towards one another, or one

may be stationary or encircled. They may have the same or differing missions. A link-up operation could occur under the following circumstances:

a. A link-up between two forces engaged in converging attacks may take place when each force captures adjacent objectives, thus completing encirclement.

b. A link-up with encircled or cut-off forces may take place on the perimeter of the defensive position established by that force. When the link-up is combined with a breakout action, it may take place at another designated objective. The encircled force should try to break out or at least mount some form of diversionary action in order to ease the task of the relieving force by diverting adversary attention.

c. A link-up operation with an air delivered or infiltrated force may take place on the perimeter of its defensive position. In this case, the link-up is normally followed by a passage of lines or by a relief of the forces involved.

27. The link-up presents a great challenge to an EW element. In addition to identifying and locating the adversary, EW will also be required to identify friendly forces as well. When the other force is encircled or of another nation, Blue SA tools may not identify the forces as precisely as our own forces. As a result, EW will need to separate adversary from friendly at the point of link-up.

28. **Withdrawal**. A withdrawal occurs when a force disengages from an adversary force in accordance with the will of its commander. It seeks to disengage its combat forces from the adversary although contact may be maintained through other means such as indirect fire, reconnaissance or surveillance. The order to withdraw will not normally be given by the commander without the agreement or direction of his superior commander. A withdrawal may be undertaken for the following reasons:

a. if the object of the operation cannot be achieved and the force is threatened by defeat;

b. the objective is achieved and there is no further requirement to maintain contact;

c. to avoid battle in unfavourable tactical conditions;

d. to draw the adversary into an unfavourable posture, for example, to extend his lines of communication;

e. to conform to the movements of adjacent friendly forces;

f. to allow for the use of the force or parts of the force elsewhere; and

g. for combat service support reasons, i.e., the force can no longer be sustained.

29. Electronic warfare units perform in the withdrawal in much the same way as during the covering force battle in the defence or as they would in the delay.

30. **Relief**. When combat activities are taken over by one force from another, this is referred to as the conduct of relief operations. Relief operations are undertaken when forces:

a. are unable to continue with their mission;

b. are required for operations in another area;

c. have accomplished their mission;

d. are due for rotation to avoid exhaustion; and/or

e. are not suitable to accomplish the new task.

31. Electronic warfare assets must be rotated in much the same way as manoeuvre units. During a relief in place, security is gained by concealing the fact that the relief is taking place or by concealing the time or progress of the relief. Frequencies and emissions must be controlled so that the adversary does not detect a sudden increase in activity. This is of particular concern when the relief is conducted with a force of another nation that may have equipment that operates on different frequencies.

CHAPTER 9
OPERATIONS OTHER THAN WAR

SECTION 1
GENERAL

1. In operations other than war (OOTW), information collection takes on an even greater significance. At times, the information operations (IO) plan might even be considered to be the main effort. As a result, all of the assets of the formation may be dedicated to the IO effort to a certain extent. As an integral element of IO, electronic warfare (EW) assets will almost exclusively be dedicated to the information acquisition effort.

2. If this is the case, the commander himself may take a more active role in directing the IO effort. This is in direct proportion to the level of the threat of physical violence that might erupt during the mission. The higher the likelihood of physical violence, the faster the operational tempo, the less likely the commander and G3 are to be involved in the IO effort.

SECTION 2
PEACE SUPPORT OPERATIONS[42]

3. **General**. Peace support operations (PSOs) can involve a wide range of operations from small forces of observers monitoring compliance with a peace agreement to large-scale peace enforcement operations. While EW can play a role across this broad range, the former is likely to be too small to have sufficient assets to constitute a well-developed EW capability. The latter would have an intelligence, surveillance, target acquisition and reconnaissance (ISTAR) system, inclusive of EW assets, but it is likely to perform the same tasks in the same way as they would be performed in a war-fighting situation. As a result, this section will focus on the traditional peacekeeping force where a brigade or a battalion is deployed in accordance with an international agreement to prevent or deter the recourse to armed conflict. It should be noted that EW is likely to deploy as a "declared" asset, meaning all parties agree to deployment of the capability.

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42 B-GL-322-001/FP-001 *Unique Operations—Peace Support Operations* provides more detail on the conduct of PSO.

4. The environment of this type of mission is typically characterized by extended lines of communications and dispersed deployments. All units are likely to be involved in ISTAR tasks. While the direct threat to the force or to the mission remains low, there is likely to be more involvement in the ISTAR process by the G3 and the commander.

5. The PSO ISTAR system will be more reliant on human intelligence (HUMINT) cross-cueing in comparison to other types of operations. Human intelligence will often provide the early detection that will be used to initiate a specific EW collection effort against a target in an effort to collect specific evidence of illegal activity or in the case of a force protection role, provide early warning as to the possible intent of an adversary.

6. Typical tasks for the EW element in support of a PSO are as follows:

a. electronic surveillance from static base camp location;

b. electronic reconnaissance patrol of a specific area;

c. electronic surveillance patrol in support of a specific PSO; and

d. electronic surveillance patrol against a specific target.

All of the above tasks are tactical variations of a standing task of information acquisition.

7. **Coordination**. Coordination will be required at lower levels in PSO. In addition to the ISTAR CC at formation, ISTAR CCs, including an electronic warfare coordination cell (EWCC) element, will be required at unit level. Centralized coordination is still possible due to the slower pace of operations during PSO. When the commanding officer is involved in the ISTAR effort at unit level, it can be assumed that the formation commander is likewise involved.

8. **ISTAR/EW at Unit Level**. When a unit is conducting PSO independent of a Canadian formation, it is likely to be reinforced by ISTAR/EW assets in order to accomplish its mission. The reinforcement must include the analytical capability and the communications and information systems (CIS) necessary to accomplish the task. An ISTAR CC will be required to manage the

process and to maintain the links to national sources and to the higher formation intelligence network.

SECTION 3
DOMESTIC OPERATIONS

9. **General**. The role of EW in domestic operations is similar to the role in PSO. There is a similar range in the nature of the operations in domestic operations. The range is less related to the size of the force, but rather it is related to the degree of force that the Army is authorized to employ. Canadian Forces policy on domestic operations is currently embodied in DCDS Instruction 2/98.

10. **Types of Domestic Operations**. DCDS Instruction 2/98 defines five broad categories of domestic operations:

a. **Provision of Services**. Provision of services occurs when military resources are loaned to municipal government or other agencies. Costs may be borne by the department or may be charged back to the requester. It is unlikely that EW assets would be used in this role.

b. **Humanitarian Assistance**. Humanitarian assistance is any action taken to save lives, prevent human suffering or mitigate property damage due to a man-made disaster, natural disaster or some other reason. EW assets can be of great value, particularly for monitoring activity in inaccessible or restricted areas.

c. **Assistance to Law Enforcement Agencies**. The CF does not have a standing mandate to enforce the laws of Canada. On occasion, CF resources will be used to support the law enforcement activities of a municipality, region, territory or province or to assist the RCMP. The assistance is usually in the form of a particular skill or asset, e.g. EW. Electronic warfare units have capabilities that may be of value in this type of assistance.

d. **Aid of the Civil Power—National Defence Act Part XI**. The Chief of the Defence Staff (CDS) may respond to requests from a provincial attorney general to use the CF in aid of the civil power. Electronic warfare assets may be employed

separately or in support of an armed force providing aid of the civil power.

e. **The Emergencies Act**. The federal government may assume special powers under the *Emergencies Act* for a critical situation of a temporary nature. This is an extreme action and would only take place in exceptional circumstances such as a massive disaster that overwhelms provincial ability to cope or a disturbance of the peace beyond the capability of provincial and federal law enforcement agencies.

11. **Constraints**. There is greater sensitivity to the use of EW in domestic operations. Electronic warfare assets are constrained by domestic legal considerations that may not apply to PSO. Canadian Forces personnel are prohibited from gathering intelligence on Canadian citizens, including the exploitation of the electromagnetic (EM) spectrum aimed at fulfilling intelligence requirements, without a specific legal mandate and direction issued by the CDS. Even when authorized, exploitation of the EM spectrum should be conducted in close cooperation with law enforcement agencies. This is to ensure that the rules of evidence are not violated, if there is any reason to believe that the information gathered or activity resulting from the information gathering is likely to become evidence in subsequent legal proceedings.

12. The Canadian Forces National Counter Intelligence Unit (CFNCIU) has the responsibility for collection of domestic security intelligence. The CF National Investigation Service (CFNIS) and the CFNCIU are the only agencies authorized to liaise with civil law enforcement agencies for police intelligence.

13. **Media**. In domestic operations, there will be a greater presence of domestic media organizations. If the operation demands the employment of military force, it will certainly be a story of great interest to the Canadian media. There are also fewer restrictions on the freedom of movement of the media during domestic operations than there would be on foreign deployments. As a result surreptitious surveillance may be more difficult to achieve than in other operations. In fact, EW may be employed in a discrete open operation.

GLOSSARY OF ABBREVIATIONS

1. This glossary contains abbreviations and acronyms commonly used in the EW environment of joint and multinational operations.

AAP	Allied Administrative Publication
AAW	Anti-Air Warfare
AAWC	Anti-Air Warfare Commander
ACC	Air Component Commander
ACCS	Air Command and Control System
AD	Air Defence
ADP	Automatic Data Processing
AEWWG	Air Electronic Warfare Working Group
AIR	Area of Intelligence Responsibility
AJP	Allied Joint Publication
AO	Area of Operations
AOC	Air Operations Centre
AOI	Area of Interest
AP	Allied Publication
APP	Allied Procedural Publication
ARFA	Allied Radio Frequency Agency
ARM	Anti-Radiation Missile
ASC	All Source Cell
ASMD	Anti-Ship Missile Defence
ASOC	Air Support Operations Centre
ASW	Anti-Submarine Warfare
ASWC	Anti-Submarine Warfare Commander
ASuW	Anti-Surface Warfare
ASuWC	Anti-Surface Warfare Commander

ATF	Amphibious Task Force
ATO	Air Tasking Order
ATP	Allied Tactical Publication
BSM	Battlespace Spectrum Management
C-E	Communications-Electronics
C2	Command and Control
C2IS (also CCIS)	Command and Control Information System
C2W	Command and Control Warfare
C3	Command, Control and Communications
C3I	Command, Control, Communications and Intelligence
CAOC	Combined Air Operations Centre
CATF	Commander Amphibious Task Force
CC	Component Commander
CCIS (also C2IS)	Command and Control Information System
CEOI	Communications Electronics Operating Instructions
CI	Counter-Intelligence
CIMIC	Civil-Military Cooperation
CIS	Communications and Information Systems
CJTF	Combined Joint Task Force
CLF	Commander Landing Force
COMCJTF	Commander Combined Joint Task Force
COMINT	Communications Intelligence
CONOPS	Concept of Operations
CRC	Control and Reporting Centre
CWC	Composite Warfare Commander

DE	Directed Energy
DEW	Defensive Electronic Warfare
DPC	Defence Planning Committee
ECM	Electronic Countermeasures
ED	Electronic Deception
EEI	Essential Elements of Information
EFIDE	Enemy Forces - Information Data Elements
ELINT	Electronic Intelligence
EM	Electromagnetic
EMCON	Emission Control
EMI	Electromagnetic Interference
EMS	Electromagnetic Spectrum
EN	Electronic Neutralisation
EOB	Electronic Order of Battle
EP	Emission Policy
EO	Electro-Optical
EPM	Electronic Protective Measures
ESM	Electronic Warfare Support Measures
EW	Electronic Warfare
EWAM	Electronic Warfare Approved Message
EWC	Electronic Warfare Coordinator
EWCC	Electronic Warfare Coordination Cell
EWEM	Electronic Warfare Employment Message
EWMS	Electronic Warfare Mutual Support
EWMS	Electronic Warfare Mission Summary
EWO	Electronic Warfare Officer
EWRTM	Electronic Warfare Request/Tasking Message

FFIDE	Friendly Forces—Information Data Elements
FMS	Foreign Military Sales
GIE	Global Information Environment
HOJ	Home-on-Jam
HPT	High Payoff Target
HQ	Headquarters
IADS	Integrated Air Defence System
IMS	International Military Staff
INFO OPS (also IO)	Information Operations
IO (also INFO OPS)	Information Operations
IR	Infra-Red
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
IW	Information Warfare
J2	Joint Intelligence Staff
J3	Joint Operations Staff
J6	Joint Communications and Information Staff
JF	Joint Force
JFC	Joint Force Commander
JFACC	Joint Force Air Component Commander
JFHQ	Joint Force HQ
JFLCC	Joint Force Land Component Commander
JFMCC	Joint Force Maritime Component Commander
JAOC	Joint Air Operations Centre
JOA	Joint Operations Area
JPTL	Joint Prioritized Target List

JRFL	Joint Restricted Frequency List
JRSRR	Joint Remote Sensor Report/Request
JSMO	Joint Spectrum Management Office
JTF	Joint Task Force
LEWOS	Land EW Operational Support
LEWWG	Land Electronic Warfare Working Group
LCC	Land Component Commander
LISS	Land Integrated Support Station
MASINT	Measurement and Signature Intelligence
MASTR	Multiple Asset Status Report
MC	Military Committee
MCC	Maritime Component Commander
MD	Military Deception
MIE	Military Information Environment
MIJIWARNREP	Meaconing, Intrusion, Jamming and Interference Warning Report
MNMF	Multinational Maritime Force
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPA	Maritime Patrol Aircraft
MSC	Major Subordinate Command
MTWWG	Maritime Warfare Working Group
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organization
NCC	National Contingent Commander
NEDB	NATO Emitter Data Base
NEDBAG	NATO Emitter Data Base Advisory Group
NEO	Non-combatant Evacuation Operation

NEWAC	NATO Electronic Warfare Advisory Committee
NEWCCG	NATO Electronic Warfare Course Coordination Group
NEWC and SO	NATO Electronic Warfare Coordinator and Support Officer
NEWWG	NATO Electronic Warfare Working Group
NIC	National Intelligence Centre
NPS	NATO Precautionary System
NSA	NATO Standardization Agency
NSIF	NATO Special Intelligence Facility
NTINADS	NATO Integrated Air Defence System
OIR	Other Intelligence Requirements (US)
OPCON	Operational Control
OPDEC	Operational Deception
OPLAN	Operation Plan
OPSEC	Operations Security
OTC	Officer in Tactical Command
PA	Public Affairs
PB	Particle Beam
PfP	Partnership for Peace
PIR	Priority Intelligence Requirement
POC	Point of Contact
PSC	Principle Subordinate Command
PSO	Peace Support Operation
PSYOP(S)	Psychological Operation(s)
PWC	Principal Warfare Commander
RC	Regional Commander

RFI	Request for Information
RFL	Restricted Frequency List
ROE	Rules of Engagement
RRI	Response to Request for Information
RWR	Radar Warning Receiver
SA	Situational Awareness
SC	Strategic Commander
SEAD	Suppression of Enemy Air Defences
SIGINT	Signals Intelligence
SIGSEC	Signals Security
SIO	Special Information Operation
SMO	Spectrum Management Office
SOF	Special Operations Forces
SPIN	Special Information
STANAG	NATO Standardization Agreement
STOPJAM	Stop Jamming Message
TACNONCOMREP	Tactical Non-Communication Report
TACP	Tactical Air Control Party
TACREP	Tactical Report
WARM	War Reserve Modes
WOC	Wing Operations Centre